TROPICAL DISEASES BUREAU.

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DISEASES DUE TO PROTOZOAN PARASITES.

BOYNTON (William Hutchins). **A Disease in Cattle in the Philippine Islands similar to that caused by *Anaplasma marginale* Theiler.**—*Philippine Jl. Sci.* Sec. B. Trop. Med. 1917. Nov. Vol. 12. No. 6. pp. 281–291. With 3 plates & 1 text-fig.

In this paper Boynton describes the occurrence of anaplasma-like bodies in the blood of three native cattle imported from Batan Island for use in connection with the manufacture of anti-rinderpest serum. On arrival at the laboratory these animals were placed in quarantine and subsequently showed a rise in temperature of from 1 to 3° C. above the average temperature of the other animals quarantined under similar conditions. They were then immediately taken out of the quarantine shed and placed with sick animals. Their blood was examined for surra parasites with negative results.

One of these animals is stated to have presented symptoms and lesions of anaplasmosis as described by THEILER and SIEBER. Twenty-three days after arrival at the laboratory it had a morning temperature of 38·6° C. and an afternoon temperature of 39·6° C. Three days later it refused food and had a depressed appearance which was still more marked after another three days, when it remained standing with its legs spread out. Its pulse was 106 per minute and its body remained covered with flies. Since no evidence of surra was found and the animal did not present the clinical picture of rinderpest, further blood examinations were made and about 30 per cent. of the red corpuscles were found to be infected with bodies similar to *Anaplasma marginale*. On the following day the animal appeared to be losing consciousness, the pulse was 98 per minute and wiry, and there was a pronounced oedema under the jaw. The afternoon temperature was sub-normal; the cow was then slaughtered as it was feared that she might die soon. On post-mortem examination the carcase showed the usual appearances accompanying marked anaemia. There was pronounced gelatinous infiltration extending along the upper part of the throat and under the jaw, the lymphatics were swollen and oedematous, the fat covering the omentum and around the intestines presented a bile-stained appearance, the gall-bladder was markedly distended with inspissated bile, the liver was very friable and of a brownish yellow colour but not appreciably enlarged, the sp'een was about 1½ times its normal size and its pulp was softer than normal, the kidneys were congested and

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on section showed small areas lighter in colour than the remainder of the organ. The mucous membrane of the intestines was slate-coloured and streaked with bile throughout its entire length, but showed no congestion. The fourth stomach contained watery bile-stained faecal matter; the urinary bladder was markedly distended with a yellowish-brown slightly turbid urine containing no blood corpuscles or haemoglobin.

Five c.c. of blood were taken immediately from the heart of the above cow and injected subcutaneously into a healthy bull. The latter was kept under observation for 226 days but never showed any ill-effects or anaplasma-like bodies in its blood during the whole of that period.

The two other affected animals showed a few anaplasma-like bodies in their blood, invading from 2 to 3 per cent. of the corpuscles, but both contracted rinderpest after the removal from the quarantine shed and died from that disease.

Blood smears and tissue sections were stained with various modifications of the Romanowsky stain but the best pictures were obtained by the use of Giemsa following the technique recommended by SIEBER (moist fixation in sublimate alcohol and prolonged staining in a dilution of Giemsa solution in distilled water, differentiation in acetone xylol, and mounting in cedar wood oil). After the use of this method the bodies were easily distinguishable as they stained of a brilliant purplish red colour. They varied in size from 0·5 microns to 1·5 microns. They were situated as a rule towards the margin of the corpuscles, in some instances causing a bulging out of the margin. In cases where two bodies were present in one corpuscle it was often found that one was situated at the periphery while the other was placed more centrally; this seemed to indicate that frequently after division one of the newly formed bodies remains at or near its original location while the other migrates across to the other side of the corpuscle. In other cases both elements, however, remained close together at the periphery of the corpuscle. The newly formed bodies after division were frequently of equal size but it was often noted that one was much larger than the other, and in some cases where division was not complete this disproportion in size gave rise to appearances similar to the budding of yeast cells. The bodies stained uniformly and appeared to be composed of a mass of chromatin with no cellular substance; a slight halo was present around the majority of the bodies. They were more or less spherical in shape with a slightly uneven border.

The author quotes at some length THEILER'S observations on the specificity of anaplasms. The above three cases were the only ones which came under Boynton's notice during a period of twenty months and thus he has been unable to perform any further work on the subject.

As these were the only cases encountered presenting pictures similar to those described by THEILER and SIEBER as anaplasma infection, it is doubtful whether the disease described by them really exists in the Philippine Islands or whether the animal suffered from some other affection which brought about the formation of the anaplasma-like bodies in the red corpuscles. Reference is made to the work of authors who have discovered anaplasma-like bodies in a great variety of other animals, and in some cases produced artificially by the injection of haemolytic substances (DIAS and ARAGAO).

GIBBINGS (G. H.) & STOCKMAN (Stewart). **The Treatment of English Redwater by Intravenous Injection of Tartar Emetic [K(SbO)C4H4O6]2H2O.**—*Jl. Comp. Path. & Therap.* 1917. Dec. Vol. 30. Pt. 4. pp. 316–320.

As the result of a few trials which, according to the authors, were possibly too few to justify a final conclusion, trypanblue did not appear to exert the same specific action on cases of English redwater due to *Piroplasma divergens* as it does in the case of tropical piroplasmosis. Moreover, this drug stains the milk and tissues for a considerable time, rendering the latter unmarketable. In experimenting at the laboratory with regard to the effect of various drugs on blood parasites when given intravenously Stockman found that tartar emetic in the dose of 1 gramme seemed to reduce the numbers of certain blood parasites of the Piroplasma class, and caused distorted forms to appear. Field experiments on the value of the treatment were carried out by Gibbings in Devonshire. It had been found at the laboratory that one to two grammes in 2 per cent. solution could be given in a single dose to an ox twelve months to two years old, and that one gramme doses were tolerated when given two or even three days in succession. It was not always possible to apply the treatment in the field at the early stage of the attack as the farmers in the district generally treated cases themselves with drenches of common salt, and did not call in veterinary help unless they were dissatisfied with the effect of this treatment.

The authors give details in tabular form of 84 cases treated with tartar emetic. Blood smears were not examined from all cases but it is considered that the parasite in practically all cases was almost certainly *P. divergens*. The tartar emetic was issued in a 2 per cent. solution in distilled water, 1 gramme dissolved in 50 c.c. constituting one dose. This was placed in sterile bottles, sterilised in the steamer, corked with sterile corks, and sealed. The injection was made into the jugular vein, care being taken that the liquid passed freely into the lumen of the vessel so as to avoid setting up phlebitis.

The table on following page is drawn up to give a brief summary of the results indicated in the authors' record of cases.

One animal that died would have lived according to the authors had it not been turned outdoors when very weak, and thus "omitting those slaughtered to save the carcase, in the above 84 cases there were 9 actual deaths (10·7 per cent.), which is a high mortality for English redwater, and is evidence that the type of disease prevailing was not mild during the time the drug was tested. Of the 9 fatal cases, 2 were treated with the drug on the first day symptoms were observed, and the other 7 fatalities occurred among animals which did not receive the drug before the third day of illness. It is also to be observed, however, that a number of animals recovered which were not treated with the drug before the third day."

Most of the cases that were injected on the first day had been treated by the owners with drenches of common salt. Four of the animals included among those that died were in a moribund condition when injected. The following cases are cited as examples of good recoveries :—

No. 20. Cow. Days ill when injected, 2. Remarks: Probably affected a couple of days before observed. Cow weak, and injected on ground; 24 hours after much improved, and following day urine clear.

No. 24. Cow. Days ill when injected, 4. Remarks: Had been drenched with common salt for 3 days in succession; urine very black and stained deeply; feeding a little; 5th day improved, and on 6th day urine clear. A very bad case.

No. 28. Cow (due to calve any minute). Days ill when injected, 5. Remarks: (1¼ doses) 1st, 2nd, and 3rd days had ¾ lb. common salt; 4th day nothing; 5th day injected, and 12 hours after there was slight improvement, then given 6 oz. common salt; 6th day urine much better, and cleared on 7th day. A very bad case.

Days ill when injected.	Urine clear within				Died	Destroyed.	Remarks.
	1 day.	2 days.	3 days.	4 days.			
1	19	17	1	—	2	7	Relapses occurred but subsequent recovery in 2 cases with clear urine in 2 days and 1 with clear urine in 3 days. In addition, recovery took place in 2 cases where time within which urine cleared is not stated.
2	5	6	1	—	—	1	2 cases, 1 with clear urine in 1 day and 1 with clear urine in 2 days, subsequently died.
3	6	4	—	—	7	—	1 case with clear urine in 1 day subsequently died. This is not included with the 7 under the heading "Died."
4	1	2	—	—	—	—	
5	1	—	1	—	—		
Not known.			—	1	—		

One case was peculiar in that the animal had a relapse three weeks after apparent recovery, and another case had a relapse four days after the urine had cleared. In one case it is noticeable that the animal became worse after injection but subsequently recovered. In the case of two animals it is stated that recovery would have taken place if they had received a second injection or drench. One animal was

injected in the earliest stage when the urine was only just coloured and the urine deepened in colour until it died; it fed well for the first three days.

It is somewhat difficult for the reader to form an estimate as to the value of the treatment from the above remarks, but, as the authors state at the commencement of their article, "having regard to the fact that many cases of English redwater recover in the absence of treatment by drugs, it is not an easy matter to assign an accurate value to any form of treatment, even when very large numbers of cases have been examined in the clinical sense."

SCHEIN (Henri). **Piroplasmose du cheval dans le Sud Annam.** [Equine Piroplasmosis in South Annam, French Indo-China.]—*Bull. Soc. Path. Exot.* 1917. Dec. Vol. 10. No. 10. pp. 871–873. With 1 text-fig.

In 1901, 150 Poitou and Algerian mules employed for military purposes were transported to a certain station in a mountainous district. At first the animals kept in a very good condition, but after the onset of the rainy season deaths occurred until all the mules soon succumbed. The principal symptom was haemoglobinuria. The cause of the mortality could not be ascertained at the time. In 1910 a mare introduced into the same district developed haemoglobinuria and other symptoms of acute piroplasmosis and the presence of piroplasms was discovered in the blood. The native horse of this region appeared to be immune to the disease; the author made a search for piroplasms in a number of their bloods and found the parasites in one 18 year-old apparently healthy horse. The morphological characters of these parasites indicated that they belonged to the species *Nuttallia equi*. The author thus assumes that the extermination of the military transport animals in 1901 was due to this species of piroplasm.

VELU (H.). **Les affections du cheval à parasites endoglobulaires au Maroc.** [Equine Affections due to Intracorpuscular Parasites in Morocco.]—*Bull. Soc. Path. Exot.* 1918. Jan. Vol. 11. No. 1. pp. 26–27.

Equine piroplasmosis was first discovered in the Chaouia district in 1908 by LAFARGUE, LUSSAULT and SAVARY, and sporadic cases of the disease are now known to occur throughout Morocco. In this note Velu asserts that these cases comprise two distinct affections, one caused by *Piroplasma caballi*, and the other by *Nuttallia equi*. The symptoms of the so-called true piroplasmosis are described. One case of nuttalliasis came under the author's notice, and this is discussed at some length.

DI DOMIZIO (Giovanni). **Comportamento biologico del piroplasma bigeminum nei bovini della Colonia Eritrea.** [The Biological Characteristics of *P. bigeminum* in Bovines in Eritrea.]—*Moderno Zooiatro.* Pt. Sci. 1917. Oct. & Nov. Vol. 5. Nos. 10 & 11. pp. 232–236; 247–259. With 1 text-fig.

In this article the author gives an account of experience gained in the course of sero-vaccination against rinderpest in Eritrea, particularly

with reference to the occurrence of redwater as a complication in that disease. According to him *P. bigeminum* is so widespread in Eritrea as to induce one to believe that all the cattle of the Colony become infected with the parasite at some period of their lifetime. The infection, however, remains latent and is not detectable clinically or microscopically, but is easily resuscitated simultaneously with the onset of symptoms of rinderpest, and to a less extent with other diseases. This phenomenon assumes considerable practical importance in connection with the use of virulent blood for rinderpest immunisation, inasmuch as the blood used may contain very numerous piroplasms intensified in virulence. The inoculation of such blood into animals of the Colony immune towards rinderpest has no untoward results, but is likely to cause much loss among susceptible animals.

The use of blood containing rinderpest virus in a state of purity would represent the ideal condition, but as this is impossible to obtain in Eritrea one should attempt to adopt methods for procuring virulent blood containing only traces of piroplasms, which are not demonstrable by repeated microscopic examination. It is thus recommended that virulent blood should be drawn on the 4th or 5th day after the onset of rinderpest symptoms, when the blood is most active and free from visible piroplasms. Virus should not be extracted from cattle during the period of diarrhoea, that is, on the 6th or 7th day of the disease, inasmuch as the virus then has become attenuated and the blood is more likely to contain large numbers of highly virulent piroplasms. Also care should be taken to allow the virus producers to contract the disease either spontaneously or by rubbing infective saliva on the buccal mucous membranes. Otherwise in the course of repeated transmission of the virus by inoculation one is likely to get a virus mixed with large numbers of piroplasms of exalted virulence.

LAVERAN (A.). **Identification des virus de trypanosomiase équine marocaine de deux origines.** [Identification of the Viruses of Equine Trypanosomiasis in Morocco obtained from Two Sources.]—*Bull. Soc. Path. Exot.* 1917. Nov. Vol. 10. No. 9. pp. 850–856.

VELU, Ed. SERGENT, LHÉRITIER and BELLEVAL studied in 1915 a trypanosomiasis of horses observed in different regions in Morocco, especially at Casablanca. The causal trypanosome was described by these authors as a new species under the name of *T. marocanum* [see this *Bulletin*, Vol. 3, p. 84, and Vol. 4, No. 1, pp. 2 and 8]. On the other hand C. FIORI, and M. and Mme. DELANOË observed a case of equine trypanosomiasis amongst some native cavalry at Mazagan [this *Bulletin*, Vol. 3, No. 3, pp. 85–86]. Laveran thought it would be of interest to find out whether the viruses from these two sources were of the same species and complete his work with reference to the identification of the Casablanca trypanosome.

A study of the morphology and pathogenicity of the above strains did not furnish any conclusive results. According to the original descriptions of FIORI and M. and Mme. DELANOË the Mazagan trypanosome was remarkably polymorphic; forms without free flagella were observed to a greater extent in the horse and especially in the rabbit than in the rat; in the rat a considerable number of trypanosomes without centrosomes were found and also the organisms attained larger

dimensions in this animal than in the horse. The Casablanca trypanosome was on the other hand monomorphic. Unfortunately, after a few transmissions through laboratory animals the morphological anomalies shown by the Mazagan trypanosome disappeared, as often occurs in such cases, and one thus had to admit that these two strains could not be differentiated morphologically. More or less similar results were obtained by the inoculation of laboratory animals, but inasmuch as the same symptoms are often manifested in widely different trypanosomiases one could not infer from these results that both strains belonged to the same species. In these circumstances cross-immunity tests were indicated. Ed. SERGENT, LHÉRITIER and BELLEVAL had already commenced experiments in this connection and shown that animals that had acquired immunity against debab (according to Laveran the trypanosome of debab is a variety of *T. soudanense*) and an infection due to *T. soudanense* could be infected with the Casablanca trypanosome, and inversely, animals with an acquired immunity against the latter trypanosome could be infected with the debab trypanosome or with *T. equiperdum*. It was thus of interest to perform similar experiments with the Mazagan trypanosome, and to ascertain the relationship between the disease caused by this organism and some other trypanosomiases, viz., the infection due to *T. soudanense*, dourine, and also surra especially as one form of this disease—mbori—has been observed in different parts of Africa.

The cross immunity tests were performed on goats and full details of the experiments are given. The method briefly consisted in inoculating a goat with a small dose of one strain and after the disappearance of trypanosomes from the blood, as proved by the inoculation of susceptible animals, the goat was again given another dose of the same strain; no infection resulted as shown by inoculation of test animals thus showing that the goat had acquired an immunity towards this strain. The goat was then inoculated with the other strain and if infection subsequently took place the result indicated that the goat had become infected with trypanosomes of different species.

The following were briefly the results obtained:—

A goat which had acquired immunity against surra (Mauritius strain) proved to be susceptible towards the Mazagan trypanosome.

A goat which had acquired immunity towards the Mazagan trypanosome proved to be susceptible towards debab; the inverse was shown in another experiment.

Goats which had acquired immunity against surra, nagana, as well as infections produced by *T. rhodesiense* were shown to be susceptible towards the Casablanca trypanosome.

A goat which had acquired immunity against surra and the infections due to *T. soudanense* and its variety *T. berberum* was shown to be susceptible towards the Mazagan trypanosome. After it had become immune against the last-named organism inoculation with the Casablanca organism failed to infect.

The following are the author's conclusions:—

"(1) The Mazagan trypanosome cannot be identified with *T. evansi*, *T. soudanense* or *T. berberum*.

"(2) The Casablanca trypanosome cannot be identified with *T. evansi*, *T. brucei* or *T. berberum*.

"(3) The Mazagan trypanosome is apparently identical with the Casablanca trypanosome, or *T. marocanum* (SERGENT, LHÉRITIER, and BELLEVAL). The goat used in the last experiment had in fact acquired an immunity against several trypanosomes when it was inoculated unsuccessfully with *T. marocanum*, but only the Mazagan trypanosome could have conferred the immunity towards this last trypanosome."

MARTOGLIO (F.). **Su di un nuovo genere di parassiti del sangue.** [A New Genus of Blood Parasite.]—*Ann. d'Igiene.* 1917. Sept. 30. Vol. 27. No. 9. pp. 561–563. With 1 plate.

The above blood parasite was encountered by Martoglio in the course of transmission experiments with *Spiroschaudinnia marchouxi* Nuttall, 1904 or *Spirochaeta gallinarum* R. Blanchard, 1905, which causes considerable mortality among fowls in the highlands of Eritrea. A fowl inoculated with spirochaetes showed after 24 hours a few of these organisms in the circulating blood. On the second day they had increased in number and on the third day they were very abundant with a tendency to become agglutinated. On the fourth day they were present in the form of very numerous small clumps but on the following two days they could not be detected under the microscope. On the ninth day after infection blood examination revealed the presence of remarkable circular flagellated bodies which increased in number until three days afterwards when the animal succumbed. A few of these bodies were also found in smears from the internal organs.

In stained preparations the flagellate showed an alveolar protoplasmic body staining of a blue colour, circular or oval in shape, and from 8·5 to 10·5μ by 10·5 to 12μ in maximum diameter; sometimes a vacuole about 3μ in diameter could be seen. It possessed a trophonucleus, which assumed a distinct chromatinic tint and was usually oval and about 2·4 to 2·8μ by 3·2 to 4·8μ, disposed towards one side. There was also a kinetonucleus which sometimes stained less intensely and was elongated in form, 0·8 to 1·0μ broad by 1 to 1·6μ long and appeared to be always disposed towards the periphery of the organism; it generally presented two distinct chromatinic granules. The trophonucleus was separated from the kinetonucleus by a distance of 1μ or less. From the kinetonucleus there arose five flagella, four of which were free throughout their whole length or adhered in pairs for a small portion near their base, and these were from 10 to 15μ in length. The remaining one bordered a distinct undulating membrane with four or five convolutions which arose in the vicinity of the kinetonucleus, and terminated at the opposite pole so as to occupy about half the periphery of the parasite. At the line of attachment to the membrane the body appeared thickened in the form of a distinct rim. The flagellum bordering the undulating membrane then had a free portion about 10 to 12μ in length. Usually the kinetonucleus, trophonucleus and point of emergence of the free portion of the flagellum bordering the undulating membrane were on the median axis. From the two chromatinic granules of the kinetonucleus there arose two curved axostyles of a chromatinic tint which lay within the body of the parasite and were directed towards the opposite extremity, so as to enclose an elongated oval space containing the trophonucleus and become re-united at the

other end of the protoplasmic body; in some cases they appeared to remain separated. Multiplication appeared to take place by longitudinal fission.

The pathogenic significance of this parasite could not be determined. Attempts at transmission gave negative results. A large percentage of deaths is often seen after the disappearance of the spirochaetes from the circulating blood of infected fowls.

From the above description the author states that the parasite possessed the characters of organisms of the Trichomonas type. He quotes references to such organisms described in cases of human dysentery and in the caeca of fowls. [He omits to refer to the occurrence of the very numerous Trichomonas in the lesions and intestinal contents of turkeys affected with the common disease known as "blackhead," as described by HADLEY (see this *Bulletin*, Vol. 5, No. 2, pp. 87–88) and JOWETT (1911) in South Africa. According to HADLEY the parasite originally described by Theobald SMITH as the cause of that disease and named by him *Amoeba meleagridis* was most probably identical with this organism. Martoglio probably encountered such parasites playing the role of secondary invaders in the circulating blood and originating from the intestine.—ED.]

On account of his discovery of the above organism in the circulating blood of the fowl the author proposes for it a new genus *Haemotrichomonas*. Organisms of this kind have already been described by PLIMMER in the circulating blood of snakes: these organisms would thus belong to the species *Haemotrichomonas ophidium* F. Martoglio 1917, while the fowl organism would be *H. gallinarum* F. Martoglio 1917.

SANLORENZO (Ferdinando). **Sulla diarrea rossa (Coccidiosi intestinale) dei bovini in Piemonte.** [Red Diarrhoea (Intestinal Coccidiosis) of Cattle in Piedmont.]—*Moderno Zooiatro.* Pt. Sci. 1917. Oct. & Nov. Vol. 5. Nos. 10 & 11. pp. 226–231; 241–247.

In this article the author gives an account of the literature dealing with the above disease together with a detailed account of the symptoms and lesions of a few cases observed by him in Northern Italy. He concludes from his observations that the disease is by no means rare among cattle in Italy and that thymol exerts a distinctly beneficial action in treatment.

RODHAIN (J.) & VAN DEN BRANDEN (F.). **Essais sur la pluralité des espèces flagellées parasitant le tube digestif des Invertébrés. Note préliminaire.** [Experiments on the Plurality of the Flagellate Species Parasitic in the Intestinal Tract of Invertebrates.]—*Bull. Soc. Path. Exot.* 1917. Nov. Vol. 10. No. 9. pp. 811–814.

The above authors have carried out some experiments since 1911 in the Lower Katanga district, Belgian Congo, with the object of ascertaining whether the cultural or developmental forms assumed by mammalian trypanosomes in the intestinal tract of Glossina can adapt themselves to the intestinal tract of non-blood-sucking insects capable of harbouring forms of animal life closely related to Crithidia.

The crithidial forms described by PATTON in the intestinal tract of a flesh-eating insect, *Gerris fossarum*, were found in 5 per cent. of the

insects examined. This species of insect was systematically fed on *Glossina morsitans* caught on the park lands and infected to a considerable extent with *Trypanosoma congolense, T. pecaudi,* and *T. cazalboui*; none of the carnivorous insects became infected. The trypanosomide forms of *Glossina morsitans* are thus not adaptable to the intestinal tract of *Gerris fossarum.* Negative results were likewise obtained by feeding Asilus on Pycnosoma, Sarcophaga and Glossina.

In the experiments briefly described in this paper the authors attempted to infect (1) mosquitoes of the Stegomyia genus by feeding on Pycnosoma known to be infected with trypanosomides; (2) *Stegomyia fasciata* on infected *Glossina palpalis*; (3) fleas of the species *Cimex rotundatus* on Pycnosoma, and also (4) on *Glossina palpalis.* Negative results were obtained throughout.

The authors conclude from these various experiments that the flagellates parasitic in the intestinal tract of a given species of invertebrate do not appear to have the power of adapting themselves to the intestine of another species of invertebrate. The negative results obtained from the experiments tend to demonstrate the plurality of the flagellate species parasitic in the intestinal tract of invertebrates.

DISEASES DUE TO METAZOAN PARASITES.

SCHWETZ. **The Western and Northern Limit of *Glossina morsitans* in Northern Katanga.**—*Bull. Entom. Res.* 1917. Dec. Vol. 8. Pt. 2. pp. 165–168. With 1 map.

The Katanga district embraces a tract of territory in the southern portion of Belgian Congo abutting into Northern Rhodesia and drained by the streams which constitute the head waters of the Congo River. The distribution of the tsetse fly in the northern portion of this region has during the last three or four years formed the subject of investigations by the author. In a previous paper on the subject (1915) he asserted that *Glossina morsitans* inhabits only those parts where the vegetation is of a particular type, viz., bush or park-like country. On several journeys made in 1913 and 1914 between the River Lualaba and the River Lomami in the region between 9° and 6° S. Lat. he was able to define the spots where the park-like country and *Glossina morsitans* disappear almost simultaneously. These spots were described as the western limit of *morsitans.* He also drew attention to the fact that between 8° and 6° S. Lat. this double limit coincided with the line of the Lualaba-Lomami watershed. During 1916 several journeys were again made between the Lualaba and the Lomami and several more points were determined in the western limit of *morsitans,* and this time also the author was able to indicate the northern limit of the fly. Details are given with regard to the journeys undertaken together with the vegetation of the country traversed and the incidence of the tsetse fly. Particulars with regard to these journeys are represented on the map. The author thus summarises his observations:—

"The hypothesis which I have previously suggested, that the limit of *morsitans* coincides more or less with that of the park (at least in Katanga), has just been confirmed by several new observations. But sometimes the

range of the fly terminates before the disappearance of the park. This double disappearance is *generally* gradual.

"Between 9° and 5° S. Lat. the western limits of the park and *G. morsitans* coincide roughly with the Lualaba-Lomami watershed, but most frequently they disappear a little to the east of this line, that is to say, they do not quite reach the Lomami basin.

"In this region, between the Lualaba and the Lomami, the park and *morsitans* gradually disappear in the neighbourhood of 5·30° S. Lat., that is, a little south of Kongolo."

SCHWETZ. **Preliminary Note on the Tsetse-Flies of the Kabalo-Albertville (Lualaba-Tanganyika) Railway.**—*Bull. Entom. Res.* 1917. Dec. Vol. 8. Pt. 2. pp. 169–175. With 1 map.

"The Kabalo-Albertville Railway is an important section of that great river and railroad route by which one can now cross the whole of equatorial Africa from Banana" (at the mouth of the Congo River) "to Daressalaam" (on the coast of German East Africa), "from the Atlantic Ocean to the Indian Ocean, without having to walk a single step. It is therefore a railway with a great future, which deserves to be studied from all points of view, and particularly with regard to the distribution of tsetse flies as the region traversed by this railway was ravaged a few years ago by sleeping sickness and the railway is probably destined in part for the transport of cattle."

Part of the route of this railway before construction was investigated by the author in 1911, and the present paper deals with a short study of the topography and the incidence of tsetse fly in the country now traversed by the railway at the beginning of 1916. The railway measures 273 kilometres, and a straight line drawn between the two termini would measure approximately 250 kilometres. From the point of view of the landscape in general and the vegetation in particular this distance is divisible into three sections:—(1) From Lualaba to the Luizi River, 63 kilometres; (2) from the Luizi River to the Niemba River, 174 km.; (3) from the Niemba River to the Lake, or Valley of Lukuga, 273 km.

The first section forms almost a straight line, and the ground is flat or slightly undulating; there is no stream in the neighbourhood of the railway. The country is wooded a few kilometres from Lualaba, but becomes gradually transformed into open, slightly wooded, meadow land a little before the Luizi. Tsetse flies are extremely numerous along this section and passengers are invariably bitten. The common species is *G. morsitans*, but two other species are known to exist here, viz. *pallidipes* and *brevipalpis*.

The second section presents different aspects in various parts but, briefly stated, it may be said to show a vegetation which is transitory between park and forest or an alternation of these two types of vegetation. The railway for some distance follows beside the stream from its source but in so doing it crosses or follows a band of forest. The study of the Glossina of this section is as complicated and difficult as that of the first section is simple and easy. Practically speaking, from the point of view of passengers, there are no tsetse in this section. However, the author was able to define certain small localities in which one or other of the following species could be found: *G. palpalis*, *brevipalpis*, and *pallidipes*; no *morsitans* was found.

The third section forms the most picturesque and interesting part of the journey, and runs alongside the River Lukuga. The valley of this river contains a park-like vegetation which has now undergone a good deal of artificial clearing in many places. During the present journey no *G. morsitans* was encountered although this fly, together with *G. palpalis* and *brevipalpis*, as discoverable in great numbers in 1911. The disappearance of *morsitans* from the railway itself has probably been caused by the gradual clearing. Some *brevipalpis* were found during the present journey, and the author is of opinion that at some distance from the railway *palpalis* and *morsitans* are also commonly found, but that all three species are so rare close to the railway itself that they need not seriously be reckoned with as regards passengers, either human or animal.

The author further argues that the scarcity of *morsitans* along the second section and its absence along the third section is really due to the species of vegetation prevalent and the clearing of the country and not, as is held by many, to the rarity of big game along these parts.

JACK (R. W.). **Tsetse Fly Investigations: Visit to Melsetter District and Portuguese East Africa.**—MS. Report forwarded to Colonial Office. 1918. Jan. 21. 11 pp. f'cap. With 1 map.

This report contains an account of a journey undertaken by the Government Entomologist of Southern Rhodesia to the Melsetter District of that territory and in Portuguese East Africa, commencing in August 1915, with the object of making investigations in connection with cases of trypanosomiasis amongst cattle which had occurred on several farms situated near the eastern border during the preceding seasons. The author summarises his observations as follows:—

"(1) A belt of tsetse fly, comprising two species, viz., *Glossina brevipalpis* Newst. and *G. pallidipes*, Aust. extends along the border in Portuguese Territory from about ten miles south of Spungabera to the Lusitu River and probably beyond. The belt is very lightly infested.

"(2) The cases of trypanosomiasis amongst cattle on farms in the Melsetter district are apparently due to an incursion of fly from this belt up the wooded river valleys during the summer months.

"(3) Infection could probably be avoided altogether by using the grazing in the eastern sides of the farms during the winter and moving the cattle to the western sides for the summer. The transference should be made before the advent of the rains.

"(4) There is no danger of an extensive invasion of this portion of the Melsetter district by tsetse.

"(5) The farms Bayswater, Farfell and possibly small portions of East Leigh and South Down might become permanent fly-belts later. Some miles of the Lusitu River within our borders might also be invaded, but owing to the scarcity of game, apart from bushbuck, along this well populated river, the suitability of conditions there is doubtful.

"(6) Fly has apparently been spreading slowly westward of late years and it is probable that the infestation of the country near our border will become intensified year by year if conditions remain as at present. The farmers on the farms affected are not likely therefore to be able to remit in future any measures adopted to avoid infection; more care is likely to be needed rather than the reverse.

"(7) The best protection against the fly would be the clearing of the forest from and in the neighbourhood of the affected farms.

"(8) There is no danger at present of an invasion of our territory by fly moving up the Sabi river valley."

ROUBAUD (E.). **Auto-inoculation et développement primaire, dans les muqueuses buccales, de la larve du Gastrophile équin (Œstre du cheval).** [Auto-Inoculation and Primary Development of the Horse Bot Larva.—*C. R. Acad. Sci.* 1917. Mar. 12. Vol. 164. No. 11. pp. 453–456.

The mode of entry of the larvae of the horse bot (*Gastrophilus intestinalis* De Geer) into the intestinal tract of their host and the primary conditions of their development are still unknown. According to certain authors (NUMAN, BRAUER) the young larvae after hatching out make their own way into the mouth and nostrils. The majority of writers, however, state that the larvae are introduced into the mouth by licking and then swallowed. The licking was attributed to the irritation set up by the presence of the small larvae on the skin.

Some Russian authors have set forth special theories on this subject based on the discovery of Gastrophilus larvae in cutaneous channels in a certain human myiasis. According to CHOLODKOVSKY the larvae after leaving the egg penetrate into the epidermis of the horse and set up an irritation which would cause the animal to bite the invaded tracts and extract the larvae from them. PORTCHINSKY, on the other hand, considers that only some of the larvae, which later die out, make their way into the epidermis; these fail to continue their development but the irritation set up by them would cause the horse to lick and collect with its tongue the other larvae which then pass into the digestive tract.

According to the author's observations the sequence of events occurs in a very different way. In the first place the eggs do not hatch out spontaneously and the primary larvae may remain within the egg in a state of latency for several weeks. Then the ripe egg liberates the larva by mechanical contact. Contact with the wet tongue is not indispensable; sudden friction against the lips or tongue fulfils the same purpose and it is well known that horses very rarely lick themselves. The primary larvae thus liberated and brought into contact with the mucous membrane of the lips or gums immediately force their way underneath the epithelium; in this position they can be seen through the transparent epithelial wall. The primary larvae unlike the larvae of Hypoderma are not capable of penetrating the skin whether dry or wet. They then make their way along through the mucous membrane of the mouth gradually increasing in size during their course. The author observed a larva for nine days on the edge of the tongue of a guinea-pig and at the end of this time it had increased three times in size and undergone a moult before entering the second stage.

EPIZOOTIC LYMPHANGITIS.

LANFRANCHI (A.). **L'Intrapalpebro-reazione nella diagnosi della linfangite epizootica.** [The Intra-Palpebral Reaction in the Diagnosis of Epizootic Lymphangitis.]—*Moderno Zooiatro.* 1917. Oct. 31. Vol. 5. No. 10. pp. 217–225. With 5 text-figs.

The diagnostic agent employed by the above author in a few cases consisted of an ethereal extract of cryptococcic pus. The pus was

taken with sterile precautions from unopened abscesses, mixed with twice its volume of ether, shaken, and allowed to stand for 24 hours. The ether was then evaporated on a water bath and the solid residue made up again to the original bulk by the addition of distilled water, stirred from time to time, and allowed to stand for 24 hours. The mixture was then heated for 15–20 minutes at 80° C. and centrifuged. The overlying liquid constituted the diagnostic agent and was injected in doses varying from 2½ to 3 c.c. according to the richness in cryptococci of the pus used.

In the case of healthy horses or those affected with glanders, strangles, botryomycosis, influenza and the common lymphangites the inoculation of the above liquid gave rise to an oedema which was limited to the seat of injection or at most spread only along the lower eyelid, and which began one or two hours after the inoculation and reached its maximum in about the 8th to the 10th hour, then became gradually re-absorbed and disappeared entirely in 20–24 hours. In the case of subjects affected with epizootic lymphangitis the local reaction began about the 2nd hour and by the 4th to the 6th hour spread along the whole of the lower eyelid, appreciably reducing in size the palpebral fissure. The oedema gradually increased and in from 20–24 hours reached downwards to the lower edge of the zygomatic crest and backwards to the angle of the jaw. This local reaction lasted for several hours and then gradually decreased in size but was quite appreciable even after three or four days. In addition to the swelling a marked degree of purulent conjunctivitis was set up. [The author does not say definitely whether the above material was tried in cases of sporothricosis. It would be interesting to know whether the same results could be obtained with extracts of common yeasts.—Ed.]

Velu (H.). i. **Nouvelles recherches sur la Pyothérapie de la Lymphangite épizootique.** [Further Researches on the Pyotherapy of Epizootic Lymphangitis.]—*Bull. Soc. Path. Exot.* 1917. Oct. Vol. 10. No. 8. pp. 681–684.

ii. **Au sujet des réactions locales dans le traitement de la lymphangite épizootique par la pyothérapie.** [Local Reactions in the Treatment of Epizootic Lymphangitis by means of Pyotherapy.]—*Bull. Soc. Cent. Méd. Vét.* 1917. Oct. 11. *Rec. Méd. Vét.* 1917. Oct. 30. Vol. 93. No. 20. pp. 380–381.

iii. **La pyothérapie de la lymphangite épizootique, telle qu'on la pratique au Maroc.** [The Pyotherapy of Epizootic Lymphangitis as practised in Morocco.]—*Bull. Soc. Cent. Méd. Vét.* 1917. Nov. 8. *Rec. Méd. Vét.* 1917. Nov. 30. Vol. 93. No. 22. pp. 452–456.

iv. **La pyothérapie dans le traitement des blessures de harnachement aux Colonies.** [Pyotherapy in the Treatment of Harness Wounds in the Colonies.]—*Bull. Soc. Path. Exot.* 1917. Dec. Vol. 10. No. 10. pp. 901–903.

v. **Au sujet de la préparation du pyovaccin contre la lymphangite épizootique.** [Preparation of the Pyovaccine for the Treatment of Epizootic Lymphangitis.]—*Ibid.* 1918. Jan. Vol. 11. No. 1. pp. 10–11.

vi. **Quelques considérations sur l'efficacité et la non spécificité absolue de la pyothérapie anticryptococcique chez le cheval.** [A Few Considerations on the Efficacity and the Absolute Non-Specificity of Anti-Cryptococcic Pyotherapy.]—*Ibid.* pp. 12–17.

An extract of a preliminary communication by the above author on the treatment of epizootic lymphangitis by means of the so-called "pyo-vaccine" has already been given recently in this *Bulletin* [see Vol. 5, No. 3, p. 186], and since then, as can be seen from the above titles, he has endeavoured to give very wide publicity to his methods.

The most recent method recommended for the manufacture of the vaccine is briefly as follows:—Pus is collected from the unopened abscesses of subjects affected with epizootic lymphangitis by means of a sterile syringe furnished with a wide bore. Also, in order to furnish a polyvalent vaccine capable of acting simultaneously on cryptococci and associated organisms in cases with complications, he recommends the collection of pus or serous fluid from the surface of open lesions or from the fissures in the crusts covering them. These products are placed immediately in a sterile flask containing a small quantity of ether and normal saline solution with ·5 per cent. carbolic acid and well shaken up. The proportions injected are pus, 1 part, ether, 1·5 parts, carbolised saline, 10 parts. If coagulation of the pus has taken place the clot is broken up by shaking with glass beads. The mixture is then filtered through from four to six layers of sterile gauze in order to eliminate coarse particles. The filtrate is then preserved in well stoppered flasks. Long continued exposure to high atmospheric temperatures does not seem to have a deleterious effect upon the vaccine.

The method of treatment as employed pretty generally now throughout Morocco is as follows:—The pyo-vaccine is administered intravenously; all recent cases of epizootic lymphangitis are amenable to treatment where no sinuses with dormant buds have yet formed. A dose of from 4 to 6 c.c. is given as a first injection. All lesions containing pus are immediately opened by means of a bold crucial incision extending into the healthy tissue and leaving behind no sinus. This is said to be a condition absolutely indispensable to recovery. The disease is first apparently aggravated with the formation of oedematous swellings around the swollen lymphatics and abscesses and an increase in suppuration and pain. This is the so-called negative phase, and is soon followed towards the 3rd or 4th day by marked improvement with decrease in size of the swellings, diminished suppuration, and lessening or even complete disappearance of pain; this is the so-called positive phase.

The second injection (1½ to 2½ c.c.) should be made towards the 8th or 10th day, sometimes the 12th, as soon as the positive phase or improvement in the symptoms begins to become less evident. The positive phase which follows the second injection is always very intense, and persistent, and when the injection is performed early it may be sufficient to bring about complete healing of the lesions by cicatrisation under scab without suppuration. In this case the treatment may be discontinued for a while.

The third injection is made in a dose of from ¾ to 1¼ c.c. at the time when cicatrisation appears to become rather slower, that is to say,

towards the 8th, 12th, or sometimes the 13th day after the second injection.

The injections are repeated until recovery takes place in the same doses of $\frac{3}{4}$ to $1\frac{1}{4}$ c.c. as soon as a retardation of the positive phase appears, that is every five or eight days. In cases where the injections are followed by an intense and persistent negative phase it is advisable to defer further injections until the disease takes on its normal course and diminish the dose of the vaccine. Every time a new abscess or fistula appears it is opened boldly as soon as possible. Injections at weekly intervals are recommended in cases where the animals cannot be kept under regular supervision. Besides the bold incision of lesions, local treatment consists in the application of such products as antiseptic dusting powders, but the wounds should not be washed.

In his earlier experiments Velu employed subcutaneous injections of vaccine and these were followed either by more or less marked oedematous swellings or small collections of pus which became discharged by necrosis of the overlying skin. In spite of prolonged contact with ether and carbolised salt solution the cryptococci were found to have survived in some cases even for two months. The abscesses formed locally in the cases of epizootic lymphangitis so treated healed quickly after opening, but a few cases treated preventatively were followed by manifestations of the disease in other regions.

There appears to be no risk of setting up the disease by means of intravenous injections. A few cases are noted in which complete recovery took place in from 17 to 22 days after the commencement of the treatment.

The above method of treatment does not appear to be specific, inasmuch as striking recoveries appeared to take place after its employment in such suppurative conditions as long standing fistulae and arthritis. Velu quotes Nicolle (Ch.) and Blaizot (L.), who noted similar properties in connection with their anti-staphylococcic vaccines prepared by treating the organisms with fluorides; also recoveries were stated to have been obtained by Wright in cases where the disease had no relationship to the organism employed for vaccinating. The author concludes that para-specific polyvalent pyotherapy is a simple economic method which, judging from the results already obtained from it, should take a first place in veterinary therapeutics.

Bridré notes that results exactly comparable to those obtained by Velu can be observed after treatment with injections of strictly aseptic pus.

Nicolle (Maurice), Fayet & Truche. **Traitement de la lymphangite épizootique, au moyen du suc de levure autolysée.** [Treatment of Epizootic Lymphangitis by Means of Autolysed Yeast Extract.] *C. R. Acad. Sci.* 1917. Dec. 31. Vol. 165. No. 27. pp. 1114–1115.

The yeast extract is prepared by autolysing for 24 hours at 37° C. pressed yeast in chloroform vapour (M. Nicolle and Adil-Bey's method). The material is then centrifuged and the overlying liquid filtered through a Chamberland F candle and carbolic acid added in the proportion of 0·5 per cent. The liquid is stored in sealed ampoules.

This material suggested itself for treatment on account of the close resemblance between Rivolta's cryptococcus and the common yeasts, and the method would thus constitute a so-called "group antigen-therapy." The authors give a short account of six advanced cases treated with injections of the above extract. Complete recoveries were obtained in from 40 to 50 days. In some cases marked local reactions were at first observed around the seat of injection together with fever and general depression. As the result of their experiments the authors recommend the injections to be carried out in the following way :—

Two c.c. are first injected under the skin of the neck in order to test the sensitiveness of the animal. After 4 to 8 days, according to the nature of the cases, the dose is raised to 5 c.c. ; in another 8 days 10 c.c. are injected ; one or two further injections of 10 c.c. each may be eventually made. The means of eliminating failures and shortening the duration of treatment are at present under study. The name "rivoltine" is proposed for the extract.

BRIDRÉ (J.). **Leucocytothérapie ou pyothérapie aseptique. Son emploi dans certaines lymphangites du cheval.** [Leucocyte-therapy or Aseptic Pyotherapy. Its Use in some Equine Lymphangites.]—*C. R. Acad. Sci.* 1917. Dec. 31. Vol. 165. No. 27. pp. 1121–1123.

Two French authors, BELIN and VELU (see above), have recently claimed to have treated cases of equine epizootic lymphangitis successfully by means of pyotherapy, that is, by means of injections of pus diluted in ether and carbolised salt solution. These authors hold that the method is analogous to WRIGHT'S vaccine therapy but admit, however, that the treatment appears to furnish equally successful results in non-specific suppurative conditions such as ulcerative lymphangitis, chronic fistulous wounds, etc. BELIN also treated by this method cases of ulcerative lymphangitis using pus taken from the lesions of that disease. As, however, the causal organism (Preisz-Nocard bacillus) is often extremely scanty in the pus any success obtained could not be put down altogether to the action of the organisms.

Bridré endeavoured to ascertain whether the results obtained could not be attributed to the action of the leucocytes or their debris and thus treated a certain number of horses suffering from epizootic or ulcerative lymphangitis with aseptic pus. Each horse was injected under the skin of the breast with 1·5 c.c. of turpentine. After four or five days 6 c.c. of pus was taken from the abscess set up and mixed immediately with 24 c.c. normal salt solution, carbolised 0·5 per cent. This mixture was thoroughly shaken up and then diluted five times and injected subcutaneously in doses of 3 to 5 c.c. at intervals of 6 to 10 days. Marked improvement is stated to have been observed after the employment of the treatment in cases of both of the above diseases, although all local treatment was neglected.

LANFRANCHI (A.) & BARDELLI (P.). **La pioterapia nella Linfangite epizootica.** [Pyotherapy in the Treatment of Epizootic Lymphangitis.]—*Moderno Zooiatro.* Pt. Sci. 1917. Dec. 31. Vol. 5. No. 12. pp. 261–275. With 9 text-figs.

In this article the above authors record a number of cases, 13 in all, of epizootic lymphangitis treated according to the methods recently described by BELIN and by VELU (see above).

The procedure as recommended by these authors is stated to have been rigorously carried out and a number of control animals similarly affected submitted to treatment by simple evacuation and washing of the abscesses. As the result of their experiments the authors emphatically declare against the use of so-called auto-pyotherapy. In no case did they observe the normal development of the disease arrested. They admit that the number of animals experimented upon was relatively small, but, on the other hand, the lines of treatment prescribed were carried out under the best conditions, and thus they conclude that the mode of treatment is not applicable to current practice.

BACTERIAL DISEASE.

PALAZZOLO (G.). **Nuove ricerche sull' eziologia e sulla trasmissione della peste de polmões (infezione da ascessi) o mal dos polmões (male degli ascessi).** [Further Researches on the Etiology and Transmission of *Peste dos Polmões* (Abscess Plague) or *Mal dos Polmões* (Abscess Disease).]—*Nuovo Ercolani.* 1917. Nov. 30. Vol. 22. No. 22. pp. 317–322. With 1 fig.

Outbreaks of the above disease cause great economic losses to cattle breeders in the States of Minas Gerâes and Paranà, Brazil.

It was first studied and described in 1912 by DIAZ (Ezequiel) and LEISBOA (Marques), who attributed it to infection with an organism of the Pasteurella group.

The disease was studied by the author on a ranch in the State of Paranà about 3,000 ft. above sea level, where the rains continue for about 120 days in the year. The daily temperature attained at certain periods 34° C. The clinical aspect of the disease is said to be typical. Young calves present a very repulsive appearance, the coat becomes ruffled, condition very weak and emaciated, and ulcerating abscesses and suppurating fistulae appear all over their bodies, which issue a very offensive odour. Numerous larvae of the "*varejeras*" fly are deposited on the ulcers. Febrile symptoms are rarely seen but diarrhoea of a haemorrhagic nature is almost invariably seen shortly before death, which usually occurs after about 12 days from the onset of symptoms from inanition.

In adult cattle the disease assumes a chronic form and in these cases one or more abscesses develop showing little tendency to ulceration and after six weeks or two months the animal usually completely recovers.

Pus taken from an unopened abscess on a naturally affected calf sown out aerobically and anaerobically on laboratory media gave rise to typical cultures of bi-polar organisms of the so-called Pasteurella group. Inoculation of broth cultures intraperitoneally into rabbits caused death in from 18 to 24 hours with abundant blood-stained exudate rich in bi-polar organisms in the serous sacs. Ten c.c. of this exudate was injected subcutaneously into a 20 days old calf. Two days afterwards there appeared at the seat of injection an abscess as large as a hen's egg and on the third day it discharged. The animal presented

no marked rise in temperature but drank very little milk and was depressed, had a rough coat and muscular tremors. On the fifth day abscesses were noticed on the buttocks and the animal became still more weakly in condition. The superficial lymphatic glands were swollen, and a febrile rise of temperature was noted. On the sixth day the animal refused all food, the secondary abscesses discharged a yellowish blood-stained foetid pus, the breathing became dyspnoeic and the pulse weak and irregular. Finally blood-stained diarrhoea set in. On the seventh day the animal became semi-comatose, with temperature sub-normal, and died. On post-mortem examination an abundant blood-stained exudate was found in the peritoneal cavity, all the viscera were congested and the lymphatic glands were markedly swollen and hyperaemic. The intestinal mucous membrane was inflamed throughout. Bi-polar organisms were recovered by inoculation of heart blood on culture media.

The disease is generally believed to be more prevalent during the rainy season, but as cattle are usually herded together and the cows generally calve at that time the author attributes the increased number of outbreaks during that season to the bad hygienic conditions under which the animals live.

DISEASES DUE TO FILTERABLE VIRUSES.

(a) Rabies.

Remlinger (P.) i. **Contribution à l'étude de la rage du cobaye.** [A Study of Rabies in the Guinea-Pig.]—*Ann. Inst. Pasteur.* 1917. Nov. Vol. 31. No. 11. pp. 537–570.

ii. **Comparaison de l'inoculation du virus rabique au lapin et au cobaye.** [Comparison between the Effects of Inoculating Rabies Virus into the Rabbit and Guinea-Pig.]—*C. R. Soc. Biol.* 1917. July 28. Vol. 80. No. 15. pp. 670–672.

iii. **Présence du virus dans la rate du cobaye rabique.** [The Presence of the Virus in the Spleen of the Rabid Guinea-Pig.]—*Ibid.* Oct. 20. No. 16. pp. 789–791.

iv. **Sur l'absorption du virus rabique par les muqueuses saines.** [The Absorption of the Rabies Virus by the Healthy Mucous Membranes.]—*Ibid.* Nov. 10. No. 17. pp. 815–817.

v. **Diffusion du virus rabique dans l'eau physiologique et le liquide de Locke.** [Diffusion of the Rabies Virus in Normal Saline Solution and in Locke's Fluid.]—*Ibid.* Nov. 24. No. 18. pp. 863–865.

vi. **Analogies expérimentales du tetanos et de la rage.** [Experimental Analogies between Tetanus and Rabies.]—*Ibid.* pp. 865–868.

vii. **Sur la présence du virus rabique dans les capsules surrénales.** [The Presence of the Rabies Virus in the Suprarenal Capsules.]—*Ibid.* Dec. 22. No. 20. pp. 951–952.

Extracts of two articles published by the above author on the peculiar symptomatology of rabies in the guinea-pig have already appeared in this *Bulletin* [see Vol. 5, No. 3, pp. 192–194]. The experimental data upon which his observations were based are detailed in

the first article mentioned above and a summary of these observations together with those of the second and sixth on the above list are set forth in the conclusions to that article :—

"Whilst the fixed virus always produces the paralytic type of rabies in the guinea-pig the street virus on the other hand may set up a disease which may show a great variety of symptoms. The furious form is one of the most commonly observed forms, but all kinds lying intermediate between the most violent and, on the other hand, the most attenuated forms may be produced. Sometimes there is no agitation whatever the predominant symptom being dyspnoea and the symptoms might easily be mistaken for any of those of the numerous epizootic pulmonary affections of the guinea-pig. The dyspnoea even may be very slight and the disease then shows greater analogy with a septicaemia than a broncho-pneumonia.

"The spasmodic form which may be observed more especially after inoculations into the anterior chamber of the eye or nasal instillation is of a very special kind. It is essentially characterised by a violent reaction both objective and subjective (pruritus) at the seat of inoculation, pharyngeal gurglings and spasms, and convulsive crises. It shows great similarity with the most common forms of rabies in man.

"The course of rabies after its onset in the guinea-pig may be extremely short. Besides the above-mentioned forms which usually run their course in from 24 to 48 hours there is a fulminant form of such short duration that the disease may escape observation and death appears to take place suddenly. It follows that in experiments on rabies every guinea-pig which succumbs without showing any symptoms should be held as suspicious. Negri bodies should be looked for and the medulla sub-inoculated.

"Paralytic rabies shows itself as a flaccid form and as a contractile or pseudo-tetanic form. Both these forms may disclose an ascending course and bring about Landry's syndrome which is so frequently observed in the course of rabies symptoms.

"A certain number of factors may exercise an influence on the symptomatology of rabies. In the course of passages from guinea-pig to guinea-pig the street virus becomes more rapidly exalted than in the course of passages from rabbit to rabbit. After from 8 to 10 passages it invariably produces death in from 5 to 7 days. The first inoculations with virus from a dog may set up paralytic rabies. After 2 to 4 passages furious rabies is on the other hand observed in its most exalted form. The violence of the symptoms becomes afterwards attenuated and there are produced dysnoeic and pseudo-septicaemic forms which are then replaced towards the 20th passage by a paralytic form and this is afterwards the type invariably seen. The mode of inoculation and in the case of intra-muscular or subcutaneous injection the seat of inoculation, the age of the animal, the dose of virus injected, etc., have also a bearing on the symptoms observed. Whilst, in the case of intracranial or intraocular injections all the various forms of rabies may be noted, inoculations into the thigh muscles or into the plantar cushion of the foot set up almost exclusively the pseudo-tetanic form. The analogy between this picture and that of tetanus is made still more manifest by the fact that in the case of subcutaneous or intramuscular inoculation the paralysis almost always commences around the seat of inoculation.

"Paralytic rabies is observed more especially after inoculation with paralytic street viruses, in the case of young animals, and after the use of large doses of virus, whilst in the case of full-grown animals and with the use of very small doses there is a tendency for the furious form to be set up. In experimental guinea-pig rabies there is no splanchnic type comparable to the splanchnic type in tetanus.

"The guinea-pig is quite appreciably more susceptible to rabies than the rabbit; the period of incubation is shorter, and very minute or attenuated doses which fail to produce any effect on the rabbit set up the disease in the guinea-pig. These facts present a considerable advantage which, however, only in part counterbalance the brief duration of the disease and its variability from the clinical point of view. This must not be lost sight of in the case of investigations on rabies."

iii. Babes appears to have been the only investigator who succeeded in transmitting rabies by spleen inoculation and he was led to believe that the spleen sometimes contained the virus, inasmuch as inflammatory and sometimes necrotic nodules could be observed in the spleens of men and other animals found dead of rabies. In Remlinger's experiments positive results were obtained in three out of 12 young guinea-pigs inoculated sub-durally and into the neck muscles with emulsions of the spleen of guinea-pigs that had died from 1–12 hours previously from rabies. Inasmuch as these results might have been produced by the post-mortem diffusion of the virus he further inoculated 12 guinea-pigs from the spleens of rabid guinea-pigs which were killed a few hours before death should have taken place, and in this experiment also positive results were obtained in three cases In a third series of experiments 12 guinea-pigs which had succumbed to inoculation with the street virus were left for 24–48 hours at laboratory temperature and the spleens were then inoculated into the muscles of the neck of susceptible guinea-pigs ; one animal only out of 12 developed the disease. Similarly, out of 6 guinea-pigs inoculated in the same way with three rabid spleens each 1 only developed rabies. This would indicate that the presence of the virus in the spleen is not due to a post-mortem generalisation.

iv. In 1903 Remlinger succeeded in transmitting rabies in 7 cases out of 12 by instillation of fixed virus on the pituitary mucous membrane of the rabbit, and these results confirmed those previously obtained by Galtier and Comte. More recently Fermi (1907) using a Sardinian virus adapted to rats obtained positive results in the case of the rat (all positive) and also with the rabbit and guinea-pig (a few failures). Repetto (1909) using this same virus arrived at a similar conclusion (3 positive results out of 5 in the case of the rat). On the other hand Galbiati (1906) and Garcia y Izcara (1905) obtained negative results only. The latter author observed that animals became affected with rabies in cases where the mucous membrane was very slightly injured and thus believed that the injury caused by foreign bodies might constitute a port of entry through the mucous membrane and give rise to errors. In his experiments Remlinger carefully avoided this source of error and out of 30 animals inoculated in the series described 11 contracted the disease. Although young guinea-pigs seemed to be more susceptible than adults the absorption of the virus through the pituitary mucous membrane appeared to be less dependent upon the state of the membrane than on the adaptation of the virus to the species of animal injected with it. Thus in the case of the rabbit the fixed virus gives a high percentage of positive results and in the case of the guinea-pig the number of positive results increases with the number of passages through the guinea-pig the virus used has been subjected to.

In 1903 the author obtained negative results only after the instillation of fixed virus into the conjunctival sac of the rabbit ; positive results, however, had been recorded by Galtier and Comte. More recently Nicholas (1904) obtained positive results in 12 cases out of 57. A fresh series of experiments undertaken on the guinea-pig with a virus adapted for this animal by means of numerous passages also furnished negative results only. These negative results are in agreement with those obtained by Garcia y Izcara, Galbiati, and Fermi. Instillations

of virus on to the mucous membrane of the vagina, penis, and anus, as in FERMI's experiments, likewise gave negative results only. The pituitary mucous membrane thus appears to be the only surface permeable to rabies infection.

v. BÜJWID (1905) showed that if healthy calf brain is placed in contact with rabies brain and kept in the dark in an atmosphere free from oxygen the normal brain becomes infective for the rabbit a few days later. NITSCH (1905) also showed that if a rabid rabbit brain is placed in distilled water or normal saline solution in an atmosphere free from oxygen the virus passes after 24 hours into the liquid.

Remlinger placed the washed brains of guinea-pigs which had succumbed to the fixed or street virus in sterilised Ringer-Locke fluid in the incubator at 37° C. for from 1–4 days. Out of 30 guinea-pigs inoculated into the neck muscles with doses of from 2 to 3 c.c. of the fluid three died of septicaemia due to contamination, 20 remained healthy, and 7 became definitely affected with rabies. The above results could not have been due to growth of the virus inasmuch as similar results were obtained after the injection of salt solution placed in contact with rabid brains and kept in an ice chest or at room temperature. It is stated that this could not have been due to putrefaction for after the immersion of the brain in various oils in which putrefaction could also take place negative results only followed inoculation of the surrounding liquid. Further after the prevention of putrefaction by immersion in glycerine the surrounding liquid was found to be more virulent than when Ringer's fluid was employed.

vii. The supra-renal capsules in animals dead from rabies have been shown to be virulent by some observers. POOR obtained positive results in one case out of every two. Inasmuch as these results have been criticised by some authors on account of the fact that not sufficient care was taken to avoid the possibility of post-mortem generalisation the author performed two series of experiments. In one of these 16 guinea-pigs were inoculated in various ways with street virus and killed several hours before death apparently would have taken place. Emulsions of the capsules in saline solution inoculated into the neck muscles of guinea-pigs gave positive results in 7 cases out of 16. In the second series 16 guinea-pigs similarly inoculated with street virus were kept at room temperature for from 24–48 hours after death. Emulsions of the capsules then inoculated into guinea-pigs gave positive results in 11 out of 16 cases. It is thus concluded that the supra-renal capsules are often virulent in the course of rabies and that the virulence is not necessarily due to post-mortem generalisation.

NICOLLE (Charles). **De l'emploi du cobaye comme animal réactif pour le diagnostic expérimental de la rage des rues.** [The Use of the Guinea-Pig for Experimental Diagnosis of Street Rabies.]—*C. R. Soc. Biol.* 1917. Oct. 20. Vol. 80. No. 16. pp. 788–789.

From motives of economy the guinea-pig has been employed since July 1916 at the Pasteur Institute, Tunis, for the above purpose instead of the rabbit. The diagnosis is made by inoculation of one drop of emulsion from the nervous centres of the suspected animal into one eye; the material had usually been forwarded in glycerine. In practice the new method was found to give as good results as when

rabbits were employed. During the year 1915–1916 rabbits only were employed, 68 inoculations were made with 32 positive results, 31 negative, and 5 doubtful. During the year 1916–1917 the guinea-pig was substituted for the rabbit; 83 inoculations were made with 41 positive results, 23 negative, and 19 doubtful. Whilst the employment of the guinea-pig was more economical it had a disadvantage in that furious rabies is of commoner occurrence than in the case of the rabbit. No accidents, however, occurred. It is stated that street rabies in the guinea-pig shows an infinitely greater variety of symptoms than in the rabbit. This has been discussed in detail by REMLINGER [see above].

BURMEISTER (W. H.). **Effect of the Injection of Nonspecific Foreign Substances on the Course of Experimental Rabies.**—*Jl. Infect. Dis.* 1917. July. Vol. 21. No. 1. pp. 95–107. With 5 tables.

"Investigations on the treatment of infectious diseases have recently received additional stimuli as a result of many favourable reports on the effect of nonspecific biochemic therapy in some of these diseases. Principal among the latter are rheumatic arthritis, gonorrheal arthritis, and typhoid fever. Experimentally, it has long been known that the resistance of animals to some infections could occasionally be raised by the injection of heterogeneous nonspecific substances. Thus Pfeiffer found that by injecting broth intraperitoneally the resistance of guinea-pigs to cholera infection was materially raised. Thus, also Babes, Fermi, and Repetto claimed to have produced immunity to rabies by subsequent treatments with normal brain tissue. Fermi claims, furthermore, to have rendered animals immune to experimental rabies by injections of fresh egg-yolk, mixtures of cholesterin and lecithin, and other lipoidal substances. The work of Babes, Fermi and Repetto have, however, not met with universal confirmation by other investigators. The objection most frequently raised to this work has been that the rabies inoculations were made subcutaneously. Their protocols present recoveries in 50–66 per cent. in relatively large series of animals. According to Koch, however, inoculations subcutaneously of rabies virus result in positive takes in only about 50 per cent. of the animals inoculated, whereas subdural or intracerebral inoculations are positive in 100 per cent. Repetto contends, however, that the percentage of positive infections in the subcutaneous inoculation of the virus in rats is greater than this, and that the results not in accord with his were obtained by others who did not repeat all the conditions of his experiments. The control series of Fermi's experiments show a high mortality. He frequently worked with an equal number of animals in the control series, and the death rate from rabies invariably was 100 per cent. His findings, that nonspecific therapy in his street virus experiments resulted in a greater number of cures than did specific treatment administered according to the routine method of Pasteur, are almost paradoxical. If legitimate criticism is to be avoided in future experimental therapeutic investigations of rabies, all animals should receive their virus inoculations subdurally or intracerebrally. True, such inoculations are most radical and do not at all resemble the manner in which man or animals usually become infected. However, unless a therapeutic measure can be discovered which will withstand the most rigid conditions, it would scarcely seem advisable to substitute it clinically for the practically universal Pasteur method of treatment."

The author then proceeds to describe a series of experiments in which 63 rabbits were inoculated in all, 17 serving as controls. These rabbits were injected subdurally with from 3 to 5 times the minimum lethal dose of virus and certain animals were then treated by intravenous injection of horse serum, egg-white, egg-yolk, broth culture media, globulin of horse serum (both anti-tetanic and anti-diphtheria

serum being used), typhoid vaccine, or tuberculin. The maximum dose of these substances compatible with the physical condition of the animal was used. A few of the animals succumbed to attacks resembling acute anaphylaxis. The following conclusions are drawn up by the author as the result of these experiments :—

"The injection of certain nonspecific substances (horse serum, serum globulin, egg-white, egg-yolk, broth, typhoid vaccine, or tuberculin) does not inhibit the course of experimental rabies in rabbits produced by non-attenuated virus. The seemingly beneficial effect of tuberculin in the early series of the experiments must be disregarded because of the survival of some control animals inoculated at a later date with the same virus.

"The results of Fermi and Repetto cannot be obtained with egg-yolk injections when potent rabies virus is inoculated subdurally or intracerebrally in rabbits.

"Rabbits surviving an intracerebral inoculation of attenuated rabies virus (fixed or street virus), may become hypersensitive to a reinoculation of the same virus made in the same way."

KOYANO (Tadayasu). **Über das Verhalten der Blutkorperchen der experimentell (durch das fixe Virus) an Tollwut erkrankten Kaninchen.** [The Composition of the Blood Corpuscles in Rabbits Experimentally Inoculated with Rabies (Fixed Virus).]—*Mitteil. a. d. Med. Fak. d. Kais. Univ. zu Tokyo.* 1917. Mar. Vol. 17. No. 1. pp. 69–85. With 6 tables & 8 figs.

In this article the author describes experiments in which a dozen rabbits were inoculated subdurally with the fixed rabies virus and the corpuscular contents of the blood were subsequently carefully estimated daily up to the time of death. The corpuscles of each rabbit were also counted before inoculation; the relative proportions of the various corpuscles according to numerous authors are also indicated. The following are the author's conclusions :—

"(1) The fixed rabies virus has no noteworthy action upon the red corpuscles of the rabbit.

"(2) In some cases no leucocytosis is caused by the fixed virus in the rabbit and in other cases only a slight degree of leucocytosis.

"(3) This leucocytosis is independent of the increase in body temperature in experimental rabies.

"(4) Polynuclear pseudo-eosinophiles constitute the majority of the white corpuscles in the rabid rabbit, especially in the course of the paralytic symptoms, whilst, on the other hand lymphocytes predominate in the normal blood of the rabbit.

"This increase in the polynuclears can be observed to a high degree first of all a few days after the subdural inoculation and then it sinks down to its normal level and rises again markedly for the second time with the onset of paralysis; this is characteristic of rabies as Courmont has already indicated.

"(5) The onset of paralysis is always accompanied by a marked increase in the young forms of the polynuclears, myelocytes, metamyelocytes and *stabkernigen*. No myeloblasts can be observed at this stage.

"(6) The eosinophiles gradually decrease in number after the inoculation.

"(7) The mast cells increase in number for a few days (at most three days) after the subdural inoculation, but this is not characteristic of rabies as it was also seen in control animals.

"(8) The large mononuclears and transition forms show no noteworthy changes.

"(9) The small lymphocytes which are about the same size or smaller than the red corpuscles decrease suddenly with the onset of paralytic symptoms. On the other hand they may be observed to increase during

the first hour or for a few days after the subdural inoculation as in the case of mast cells, but this is not specific for the fixed virus as it was also seen after inoculation with normal non-rabid brain substance.

"(10) From the above data one may infer that the fixed virus has a stimulating action upon the bone marrow so that certain changes are brought about in the blood composition and apparently some effect is also produced upon the lymphatic system. Although this effect is not pronounced during the incubation period it becomes suddenly manifest with the onset of symptoms.

"This conclusion thus lends considerable support to the probability of the presence of a rabies toxin in the blood and lymph stream especially with the onset of symptoms."

(b) Rinderpest.

Shilston (A. W.). **The Vitality of the Rinderpest Virus outside the Animal Body under Natural Conditions.**—*Agric. Res. Inst. Pusa. Memoirs of the Department of Agriculture in India.* Veterinary Series. 1917. Oct. Vol. 3. No. 1. 32 pp. With 4 plates. Calcutta: Thacker, Spink & Co. [Price As. 12 or 1*s.*].

"Although rinderpest has been the subject of extensive investigations in many countries, great uncertainty has existed with regard to the length of time the virus is able to survive outside the animal body either under natural conditions or when special measures are taken to preserve its vitality. The question of the duration of rinderpest infection, apart from affected animals is, however, of great importance in relation to the control of the disease in the field, and the observations recorded in this memoir were carried out with a view to obtaining exact information on this point under varying conditions in India."

A long list of references to the literature of the disease is given to indicate the extent to which the views of various authorities differ.

In order that the tests might be as complete as possible they were carried out by the author both at the Muktesar laboratory, 7,500 ft. above sea level and, with the exception of the tests of meat, blood, and bones, at Bareilly under "plains" conditions. The experiments in each case are described separately.

(I) *Duration of Rinderpest Infection on Ground in the Open.*

"(a) Observations at Muktesar. Several authorities who state their opinion that rinderpest infection may persist, under certain conditions, for long periods refer to the rapidity with which the virus is destroyed by exposure to sunlight.

"To determine therefore to what extent the duration of ground infection was influenced by direct sunlight, two small wire enclosures were constructed, one without any protection against the sun and the other almost entirely shaded by overhanging trees.

"For the purpose of infecting the enclosures, two "Hill" bulls suffering from acute rinderpest, with vesicles in the mouth and diarrhoea, were turned into each and allowed to remain until in a dying condition. They were then removed and at varying intervals healthy "Hill" bulls were placed in the enclosures to test the existence of infection. Each test animal was kept in the enclosure at least 24 hours, usually longer, and was afterwards disinfected and segregated with healthy "Hill" bulls to control the possibility of subsequent outside infection.

"In the case of those animals which contracted the disease, the diagnosis was confirmed by post-mortem examination or blood inoculation. The susceptibility of all animals which failed to react was subsequently tested by the inoculation of virulent blood or, in a few cases, exposure to infection in later experiments.

"During the period covered by the tests all varieties of weather conditions were experienced except great cold. The daily maximum shade temperature varied from 63° to 82° F. and the minimum from 47° to 62° F.

. . . . . .

"(b) Observations at Bareilly.—Tests similar to those described above were repeated at Bareilly. Two enclosures, one fully exposed and the other well shaded, were employed as before.

"Throughout the experiments the weather was clear and bright with a maximum shade temperature varying from 100° F. when the observations were commenced, to about 75° F. at their close: the daily minimum temperature varied from 70° to 45° F. during the observations."

The author gives brief and concise details of these experiments.

In the following table a summary of these experiments is given.

Number of Experiment.	Intervals after removal of the sick animals at which infectiveness was tested.	Result.
	1. *Ground exposed to direct sunlight.*	
	(a) *At Muktesar.*	
1	1 and 2 days	Infection absent.
2	16 and 20 hours	,, ,,
3	16, 20, and 24 hours ..	,, ,,
4	12, 24, and 30 hours ..	,, ,,
5	5, 8, and 20 hours	,, ,,
6	5, 8, and 20 hours	Infection present after 5 and 8 hours but not after 20 hours.
7	5, 8 and 20 hours	Infection absent.
	(b) *At Bareilly*	
1	8, 20, and 32 hours	Infection absent.
2	6, 12, and 24 hours	Infection present after 6 hours but not after 12 and 24 hours.
3	4, 8, and 20 hours	Infection present after 4 hours but not after 8 and 20 hours.
	2. *Ground shaded by trees.*	
	(a) *At Muktesar.*	
1	2, 3, and 4 days	Infection absent.
2	44, 56, and 72 hours ..	,, ,,
3	32, 48, and 56 hours ..	,, ,,
4	6, 18, 30, and 48 hours ..	Infection present after 6 hours but not after 18, 30, and 48 hours.
5	6, 18, 30, and 48 hours ..	Infection present after 6 and 18 hours but not after 30 and 48 hours.
	(b) *At Bareilly.*	
1	8, 20, and 32 hours	Infection absent.
2	8, 20, and 32 hours	Infection present after 20 hours but not after 32 hours.
3	8, 24, and 48 hours	Infection present after 24 hours but not after 48 hours.

"Conclusions.—(1) In the hills open ground free from vegetation and exposed to direct sunlight, when heavily infected by animals suffering from rinderpest, was found to be infective for healthy cattle eight hours after removal of the sick animals but not for a longer period. In the plains under similar conditions infection did not persist for more than six hours.

"(2) When protection from direct sunlight was provided the rinderpest virus was found to survive on the ground in the hills for 18 hours and in the plains for 24 hours but not for longer periods. In some of the experiments infection was absent after similar or shorter intervals of time."

(II) *Duration of Rinderpest Infection in Closed Sheds.*

(a) Observations at Muktesar.—"In order that the conditions under which the tests were carried out might be as variable as possible, two sheds were utilised. One was a well built masonry stable with slate and cement floor and the other a rough wattle-and-mud erection with thatched roof and plain earth floor, the latter being the common type of cattle shed found in the hill districts.

Number of Experiment.	Intervals after removal of sick animals at which infectiveness was tested.	Result.
	(a) *In stone stable at Muktesar.*	
1	4, 5, and 6 days	Infection not present.
2	32, 56, and 80 hours ..	" " "
3	24, 48, and 72 hours ..	" " "
4	6, 18, and 30 hours	Infection present after 6 and 18 hours but absent after 30 hours.
	(b) *In wattle-and-mud shed at Muktesar.*	
1	2, 4, and 6 days	Infection present after 2 days but absent after 4 or 6 days.
2	3, 4, and 5 days	Infection not present.
3	24, 48, and 57 hours ..	Infection present after 24 and 48 hours but absent after 57 hours.
	(c) *In open stables at Bareilly.*	
1	12, 24, and 48 hours ..	Infection not present.
2	12, 24, and 48 hours ..	Infection present after 12 hours but absent after 24 and 48 hours.
3	12, 24, and 48 hours ..	Infection present after 12 hours but absent after 24 and 48 hours.
4	8, 20, and 44 hours	Infection present after 8 hours but absent after 20 and 44 hours.
5	8, 20, and 32 hours	Infection present after 8 and 20 hours but absent after 32 hours.
6	8, 20, and 32 hours	Infection present after 8 and 20 hours but absent after 32 hours.

"Hill bulls suffering from rinderpest were placed in the sheds to infect them and were left there until a short time before death; no litter was taken from the sheds during an observation. At intervals after the removal of the sick animals healthy Hill bulls were turned into the sheds and left for at least 24 hours to test whether the rinderpest virus was still capable of causing infection. Later the test animals were isolated in company with healthy bulls to control the possibility of outside infection. The susceptibility of all animals failing to react was subsequently tested by an injection of virulent blood or successful exposure to natural infection in later experiments.

"*Post-mortem* examinations and, if necessary, blood inoculations, were carried out in the case of all animals which died without having shown diagnostic symptoms during life.

"During the observations the daily maximum shade temperature varied from 56° to 73° F. and the minimum from 37° to 57° F.

. . . . . .

"(b) Observations at Bareilly.—For these tests two stables of similar construction were employed. Each was built of brick, closed on three sides but open on the fourth, with tiled roof and earth floor. The tests were carried out as in previous experiments. The variation in shade temperatures were the same as noted under the tests of ground infection."

The table on page 27 gives a summary of the results obtained.

"Conclusions.—(1) In the hills, rinderpest infection was found to persist in a stone stable with slate floor for 18 hours after removal of the sick animals, but not for longer periods.

"(2) In a wattle-and-mud shed with earth floor and no windows, in the same situation, rinderpest infection persisted for 48 hours after removal of the sick animals, but not for longer periods.

"(3) In the plains, open stables were found to be infective up to 20 hours after removal of the sick animals, but not for longer periods."

(III) *Duration of Vitality of the Rinderpest Virus in Faeces, Urine and Mucus Discharges.*

"In the foregoing observations the method of testing the presence of rinderpest infection by placing healthy animals on the infected areas, although simulating natural conditions most closely, does not allow of precise conclusions being drawn as to the vitality of the virus owing to the possibilities of accidental avoidance of the infected material by the test animals. The following experiments were therefore carried out to test more accurately the length of time that the virus can maintain its vitality in faeces, urine, and mucus discharges from animals suffering from rinderpest.

"(a) Observations made at Muktesar.—The material was collected from sick animals at the height of an attack and kept at room temperature in open vessels. At intervals portions of it mixed with a small quantity of meal were fed to healthy cattle. Owing to failure to produce infection in the first two experiments by this method of administration some of the material was also rubbed into the nostrils and on the muffle of the test animals in the subsequent observations.

. . . . . .

"(b) Observations made at Bareilly.—As the purpose of the tests with discharges from sick animals was to control the observations ca ried out in the enclosures and various buildings under more natural conditions, the procedure followed at Bareil'y was to collect and mix the material and

divide it into two portions; one half was then stored in the shade at air temperature and the other exposed to direct sunlight in the open. At intervals the infectiveness of each portion was tested on healthy hill bulls as in the experiments at Muktesar.

"The daily maximum shade temperature varied from 82° to 95° F. and the minimum from 58° to 68° F., during the observations."

The above experiments are summarised in the following Table :—

(a) *Observations at Muktesar.*

No. of Experiment.	Material.	Intervals after collection at which infectiveness was tested.	Result.
1	Faeces . .	48 and 72 hours .	Not infective.
	Urine . .	,, ,, .	
2	Faeces . .	36 and 48 hours .	
	Urine . .	24 and 33 hours .	
3	Faeces . .	28 and 44 hours .	Infective after both intervals.
	Saliva and nasal discharge.	,, ,, .	Infective after both intervals.
4	Faeces . .	29, 48, and 54 hours	Infective after all intervals.
	Saliva and nasal discharge.	,, ,,	Infective after 29 hours, but not after 48 and 54 hours.
5	Faeces, saliva and nasal discharge mixed	48, 66, and 78 hours	Not infective.
	Faeces . .	30, 48, and 72 hours	Infective after 30 and 48 hours, but not after 72 hours.

(b) *Observations at Bareilly.*

No. of Experiment.	Conditions under which mixed faeces and urine were kept.	Intervals after collection at which infectiveness was tested.	Result.
1	In shade .	12, 24, and 48 hours .	Not infected.
	In sun . .	6, 12, and 36 hours .	Infective after 6 hours, but not after 12 and 36 hours.
2	In shade .	,, ,, ,, .	Infective after all intervals.
	In sun . .	,, ,, ,, .	Infective after 6 hours, but not after 12 or 36 hours.
3	In shade .	8, 24, 48, and 72 hours	Infective after 8 and 24 hours, but not after 48 and 72 hours.
	In sun . .	8, 24, and 48 hours .	Infective after 8 hours, but not after 24 and 48 hours.

"Conclusions.—(1) At Muktesar faeces and urine collected from animals suffering from rinderpest during the later stages of the disease and stored in the shade at air temperatures varying from 54° to 73° F. remained infective to healthy animals up to 54 hours after collection, but frequently these materials become non-infective after shorter intervals. In the plains at slightly higher temperatures, faeces and urine were found to be non-infective beyond 36 hours.

"These observations confirm the results obtained by exposure of healthy cattle in sheds, and in enclosures shaded by trees at intervals after the removal of sick animals.

"(2) When exposed to direct sunlight the virus survived in mixed faeces and urine for 8 hours but not for 12 hours; in the same materials kept in the shade the virus survived for 36 hours. The results obtained in infected enclosures, without shade, are therefore confirmed.

"(3) The rinderpest virus survived in mixed saliva and nasal discharge kept at room temperature for 44 hours. It appeared to be less resistant in these discharges than in faeces and urine, since in one observation the infectiveness of saliva and nasal discharge was lost 48 hours after collection although faeces and urine from the same animal remained infective for 54 hours."

IV) *The Length of Time after the Death of the Animal that Rinderpest Virus can survive in Meat, Blood, and Bone Marrow under Natural Conditions.*

"In addition to the excreta and mucus discharges of sick animals, the carcases of those that have died from rinderpest have also to be taken into consideration as possible sources of infection to others, especially as such carcases are commonly left to be broken up and carried away by birds and beasts of prey; it is important, therefore, to know how long the rinderpest virus can survive in the animal tissues after death.

"A large number of observations have recently been made on the preservation of the rinderpest virus in a virulent condition in connection with the immunisation of Government cattle by the serum simultaneous method, but only those carried out with material stored under natural conditions will be recorded in the present report.

"All the tests were carried out at the Muktesar Laboratory. Blood for these observations was usually taken from a hill bull in the last stages of an attack of rinderpest and about 500 c.c. kept in an open dish at room temperature without protection of any kind; its infectiveness was tested at intervals by injecting 1 c.c. subcutaneously into a healthy hill bull.

"Meat and bones were removed as soon as an animal in the last stages of the disease had been bled to death, and both were left exposed at room temperature. The meat was cut from the hind quarters in pieces of about 6 to 8 lb. weight; the survival of the rinderpest virus was tested by cutting out a small piece from the depth of the tissue, crushing it in a mortar with a few cubic centimetres of normal saline solution and injecting the fluid into a healthy hill bull.

"The infectiveness of the bones was tested by sawing one of these open, removing the marrow and mixing it with normal saline solution; the fluid, filtered through muslin, was then injected subcutaneously into a healthy hill bull."

The author then gives details of these experiments including the variation in temperature during the period of the experiments and the condition of the material in each case at the time of administration.

The following table gives a summary of the results obtained :—

Experiment.	Hill bull.	Material taken.	Intervals of exposure at air temperature after which tested.	Result.
1	7108	Blood . .	3 and 6 days .	Not infective.
		Meat . .	3, 6 and 10 days .	Infective after 3 days but not after 6 and 10 days.
2	7192	Blood . .	2, 3, 4 and 9 days .	Infective after all intervals.
		Bone marrow	5 and 9 days .	Infective after both intervals.
		Meat . .	3, 5 and 9 days .	Infective after 3 and 5 days; test animal injected with 9 days old meat found to be immune.
3	7257	Blood . .	2, 3, 4, 5, 7 and 9 days	Infective at all intervals up to 7 days, but not infective after 9 days.
4	7273	Bone marrow	3, 6, 9 and 15 days	Infective after 3 and 9 days, not infective after 15 days. Test animal injected with 6 days old marrow found to be immune.
5	7338	Blood . .	3, 5, 7 and 9 days .	Infective at all intervals.
6	7590	Blood . .	3, 6, 9, 12, 15, 16, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48, 51, 57, 63, 69, 75 and 81 days . .	Infective at all intervals up to 51 days, but not infective after 57 days.

"Conclusions.—(1) The length of time that the rinderpest virus is able to survive in blood from a sick animal kept at air temperature in an open vessel varies within wide limits; in one observation such blood was non-infective after 3 days' exposure, while in another it remained infective for 51 days although putrefaction set in after a few days' exposure and by the 30th day the blood was completely desiccated. In two other observations blood was still infective after 9 days' exposure to the air and in a third it was infective after 7 days' but non-infective after 9 days' exposure.

"(2) In two observations the virus maintained its vitality in bone marrow for 9 days, but in one of these cases infectiveness was lost after 15 days.

"(3) Meat was infective after 3 days in one observation when blood from the same animal was non-infective within that period; in another case meat remained infective for 5 days.

"(4) Further tests are necessary to determine the factors influencing the survival of the rinderpest virus in animal tissues under natural conditions; the temperature at which the material is kept appears to have a considerable effect, possibly in determining the rate and character of the putrefactive changes taking place, but it has been shown that these may not destroy the virus as rapidly as many authorities have stated to be the case."

SCHEIN (H.). **Etudes sur la Peste Bovine.** [Studies on Rinderpest.]—*Ann. Inst. Pasteur.* 1917. Nov. Vol. 31. No. 11. pp. 571-592.

Whereas satisfactory results have been obtained in the case of oxen by the simultaneous injection of serum and virus this procedure applied to buffaloes in the hands of the author and his colleagues has led only to disastrous results, causing a mortality in certain herds of up to 60 per cent. Acting upon the advice of ROUX the author has carried out investigations during the last few years in order to ascertain whether an immunity could be obtained by the use of sensitised viruses prepared in the same manner as described by BESREDKA for human typhoid fever and BRIDRÉ for sheep pox. The use of mixtures of serum and virus was tried by KOLLE without success as far back as 1898 when, however, little knowledge existed regarding the phenomena of sensitisation. REFIK Bey, a pupil of M. NICOLLE, apparently obtained satisfactory results by the use of this method, but unfortunately they were not published.

Schein's experiments, carried out in French Indo-China, were performed on goats, the supply of calves having become exhausted. The goat appears to constitute an excellent animal for maintaining the virus. The effects of inoculation are somewhat irregular during the first few passages, but in the course of further sub-inoculations it seems to become accustomed to the new host. At present the inoculated animals die rapidly without exception; the first fifty passages of the virus gave 87 deaths out of 100 animals, each inoculated with $\frac{1}{2}$ c.c. of virulent blood. In another series of passages four animals survived out of the first twelve animals inoculated with $\frac{1}{2}$ c.c. each, while only one survived out of the following twelve successively infected. The activity of the virus does not appear to be affected in the course of a large number of passages through the goat; virus taken at the 59th and 169th passages produced a reaction and subsequent recovery in inoculated calves, but a calf infected with virus after 172 passages died.

Almost all authors admit that the rinderpest virus is to be found within the corpuscles of the blood. BOYNTON, however, claimed that the red corpuscles or leucocytes used separately failed to set up the disease. The author, however, states that he was led to the same conclusions as KOLLE on repeating that author's original experiments, viz. (1) after the clotting of virulent blood the serum has lost its virulence; (2) the deposit of corpuscles obtained by centrifugation of defibrinated blood remains virulent; (3) corpuscles obtained by centrifugation of citrated blood are virulent; the plasma obtained in this way also remains virulent, thus differing from the serum, but it appears to be far less active than the corpuscles. Seven c.c. of plasma gave rise to a fatal infection, 1 c.c. produced only a strong reaction followed by immunity, while $\frac{1}{10}$th c.c. and smaller quantities gave negative results.

The serum obtained from hyper-immunised cattle exhibited no haemolytic action on goat corpuscles, even when added in large proportions (2 of serum to 1 of corpuscles) for 24 hours.

The author failed to discover any means of preserving the virus. Washed defibrinated corpuscles incorporated in a solution of gelatin and kept for 15 days in an ice chest had lost their infectivity. Bone-marrow, which was claimed by LINGARD to retain the virus for a long period, failed to infect after storage in the ice chest for one month.

In the course of the author's experiments on sensitisation he endeavoured to determine approximately the quantity of infective material contained in 1 c.c. of blood, taken in every case on the 7th day after infection. One c.c. of 1–1,000 dilution of whole or defibrinated blood was found to be always virulent and thus the author employs this dose in maintaining the virus by sub-inoculations in the laboratory. To test the efficacy of this small quantity as compared with larger doses a series of sub-inoculations were made. The first 12 goats received $\frac{1}{2}$ c.c. each of undiluted blood; all died except 4, the 6th to the 9th inclusive. The following 11 animals each received successively 1 c.c. of 1–1,000 dilution; all died except 4. the 5th and the 9th to the 11th, inclusive. The following 12 then received $\frac{1}{2}$ c.c. each of undiluted blood; all died except 1, the 7th. The following 12 each received a dose of the 1–1,000 dilution; all died except the 8th. 0·001 c.c. thus appears to be quite as virulent as 0 5 c.c.

A number of experiments were made with weaker dilutions of whole blood diluted with saline solution immediately after bleeding, the dose given being 1 c.c. in each case. The limit of infectivity was reached by the employment of 1–25,000 dilutions; 8 animals were thus inoculated; 4 reacted, out of which 3 died. Dilutions of 1–50,000 and 1–100,000 failed to infect. Vaccination by means of successively smaller dilutions was found to be unreliable, as already shown by M. NICOLLE. It is thus calculated that as 1–25,000 appears to be the limit of infective dilutions there would be about 25,000 organisms or groups of organisms in 1 c.c., or 25 in one cubic millimetre. If the virus is situated in the white corpuscles there would thus be only one affected leucocyte out of every 320, and this would explain BOYNTON'S failure to reproduce the disease by the inoculation of only one or two white corpuscles.

The comparative virulence of the red and the white corpuscles was next studied and a method for obtaining these elements in an approximately pure condition by centrifugation is described. It was found that the deposit of pure red corpuscles was never virulent in dilutions of 1–5,000 whereas the whole blood was constantly infective in 1–10,000 dilutions. The white corpuscles, however, proved to be infective in one out of three trials in dilutions of 1–50,000 or probably higher. This would appear to confirm M. NICOLLE'S opinion that the virus is to be found chiefly within the leucocytes.

Plasma obtained from centrifuged oxalated blood produced fatal results in two cases in doses of 1 c.c.; out of three animals inoculated with $\frac{1}{10}$th c.c. one died, one reacted, and one remained unaffected; out of 6 inoculated with $\frac{1}{20}$th c.c. 2 died and 4 were unaffected and remained susceptible; with $\frac{1}{30}$th c.c. 2 animals died and 1 was vaccinated. It is stated that there would thus be probably about 20 organisms in 1 c.c. of plasma, that a single organism is capable of producing death in susceptible animals, and that the rare cases of vaccination obtained by the use of dilutions of blood or plasma must be attributed to the individual resistance of the inoculated animals.

In a series of experiments on the action of specific anti-sera on the rinderpest virus *in vivo* using the goat as test animal the following were briefly the results obtained:—Ox anti-rinderpest serum, injected simultaneously with 1 c.c. of virulent blood, appeared to have an

appreciable protective action but this did not seem to be very great, constant, or durable. Buffalo anti-rinderpest serum was similarly tested in 4 cases, and death resulted in each case. It would thus appear that serum from immune buffaloes is very poor in anti-bodies. Goat anti-serum seemed to be more active than ox serum, given in doses of 5 c.c. The dose of serum injected cannot be diminished relatively to the quantity of virus given; thus out of 5 animals inoculated with 1 c.c. of goat anti-serum two survived and became immune although they had been inoculated at the same time with $\frac{1}{2}$ c.c. of virulent blood; on the other hand the other three received very weak dilutions—two 1–4,000 and the third 1–1,000—and died. The serum must thus owe its preventive action not to its effect upon the infective material, but to the strengthening of the defensive powers of the body. These results did not enable the author to hold forth much hope from the results of sensitisation. It is stated that *a priori*, however, it would appear advantageous to produce infection by inoculating very much smaller doses of virus, viz., $\frac{1}{1000}$th c.c. of blood.

With regard to the action of non-specific substances on the virus it was found that normal saline solution produced no appreciable effect but in some cases normal ox serum seemed capable of attenuating or destroying the goat virus. Normal goat serum had no action on the goat virus.

A number of experiments were then made to ascertain the action of specific ox and goat sera, heated and unheated, on virulent blood or washed corpuscles when mixed together in various proportions. The results obtained after inoculation of such mixtures were very contradictory and did not furnish any definite evidence of sensitisation. Taking into consideration the action of normal ox serum the effects produced could be assigned to the very low resistance of the virus outside the animal body.

Having in mind the experience obtained with regard to the dilution of virus and effects of serum as applied to goats, the author proceeded to apply it to a number of outbreaks of rinderpest occurring in six villages in French Indo-China. These outbreaks were all of a sub-acute nature. In one village where the disease was allowed to run its course there were 71 oxen, 17 became infected and 5 died, and out of 145 buffaloes 57 became affected, with 23 deaths. The method of vaccination employed was as follows:—Cattle received each from 40 to 80 c.c. of serum according to size and age and buffaloes from 100 to 160 c.c. (i.e., 50 c.c. per 1,000 kilos. for adults and double that quantity for the young more susceptible animals). All inoculated animals were injected with 1 c.c. of a 1–1,000 dilution of virulent blood. This was obtained by withdrawing a couple of c.c. from the jugular vein of an affected animal and placing 1 c.c. in a litre of sterile saline solution (common salt 8 grammes, sodium oxalate 2 grammes). This was shaken up from time to time to prevent deposition of the corpuscles and dilutions were made from freshly drawn blood twice a day. Out of 557 oxen inoculated 117 became infected and none died. Out of 477 buffaloes inoculated 128 became infected and 14 died. In three of the villages virus taken from naturally affected animals was employed and it is noticeable that the mortality in these cases was markedly lower than in the other villages where the laboratory virus was used.

ANGELOFF (St.). **Auftreten und Bekämpfung der Rinderpest im Königreich Bulgarien während des Balkankrieges 1912-1913.** [Rinderpest in Bulgaria during the 1912–1913 Balkan War.]—*Arch. f. Wiss. u. Prakt. Tierheilk.* 1917. Nov. Vol. 43. No. 6. pp. 383–420. With 7 text-figs. & 10 charts.

In the past rinderpest has nearly always gained access to the Balkan Peninsula from Asiatic Turkey, where the disease is enzootic. This is known to have taken place in the case of the outbreaks of 1853 and 1863 which caused great losses among cattle in the neighbourhood of Tschataldja. During the war of independence in 1877–1878 rinderpest was introduced by means of either Russian or Turkish transports into what were then the Eastern Provinces of Turkey in Europe, and after the war it spread throughout the newly formed Principality of Bulgaria and with especial severity in its Southern Provinces. Owing to the measures taken by the new Government the disease was brought under control and eradicated. Almost two-thirds of the cattle of Bulgaria were lost in this epizootic. Five years later, that is, in 1883, rinderpest was introduced into the town of Varna on the Black Sea coast, by means of cattle brought from Russia for breeding purposes. By enforcing slaughter of all affected and in-contact animals in the surrounding district where the disease had broken out the epizootic was soon eradicated. By means of measures introduced for the regulation of exportation and importation of stock and animal products the country remained free of the disease from that time until recently, although in the meantime it had appeared in Turkey in Europe and in 1906 it was observed close to the frontier. During the war against Turkey from 1912 up to its end in 1913 rinderpest did not appear to have left its centres in Asia Minor; at least, it was never observed in Thrace. However, during the second part of the war when Bulgaria was attacked (!) by her former allies Serbia and Greece and also by Roumania the Turks took the opportunity of re-occupying that part of Thrace which had been taken from them and their troops crossed from over the Maritza into Bulgaria. As all the cattle in Thrace had been slaughtered and taken away during the war the Turks brought for provisioning and transport cattle which could only be obtained from Asia. With these cattle they also brought rinderpest; it is well known that the disease was introduced into Thrace with the 4th Erzerum Division in July 1913, and in a short time spread throughout the whole of the territory re-occupied by the Turks, and thence fugitives from Thrace brought it with their cattle over the frontier into the south-eastern districts of Old Bulgaria and over the Maritza up to Grimildjina on the Aegean Coast. Owing to the movements of fugitives in all directions the outbreak assumed a very widespread character and caused great losses until a number of veterinarians were released from the Army to deal with it; the losses then rapidly diminished. In the four districts affected in South-Eastern Bulgaria the losses amounted to 4,555 head of cattle, of which 2,856 died from the disease and 1,339 were slaughtered. This would correspond with a mortality rate of 62 per cent. up to the time of slaughter. The first cases were reported towards the end of October 1913, and the disease was definitely diagnosed by the author in November 1913 in the neighbourhood of Adrianople among transport

oxen, which had been employed by peasants for carrying booty left by the Turks as far forward as Gallipoli and had become infected on the return journey.

The author then gives a very clear account of the clinical and post-mortem appearances manifested by affected animals during the outbreak. The course of the disease was for the most part acute; the symptoms were at their height in from 4 to 6 days; hyper-acute and sub-acute cases were seldom observed. On the other hand cases running an abortive course were often observed, especially among the native grey breed; the affected animals showed no visible symptoms beyond a high temperature or slight loss of condition for a couple of days. Buffaloes were usually more resistant than cattle and generally the disease ran in them a milder course. The infection had much less tendency to spread than in the case of the other contagious diseases of the country, viz., foot-and-mouth disease and sheep-pox. All the cattle in one shed did not become affected when they were separated a short distance from one another. In one town with a Turkish population the disease remained for five months uncontrolled but only 510 out of 771 cattle became affected, or 66 per cent. According to the author's observations the susceptibility of the Bulgarian grey breed is much less than that of other European breeds. In the neighbourhood of Burgas Swiss and Dutch cattle were kept in sheds; all the cattle became infected and the mortality rose to 95 per cent. while the average mortality among native cattle was 62 per cent.

Exanthematous lesions on the skin were only observed in two cases out of several hundred examined. The author gives indications for the differential diagnosis of the disease from the conditions with which it is most likely to be confused in Bulgaria, viz., haemorrhagic-septicaemia, foot-and-mouth disease, piroplasmosis, and acute gastro-enteritis.

During the course of his work at the temporary rinderpest serum station at Lidjaken near Burgas Angeloff carried out a series of very interesting short investigations. A careful microscopic examination of the tissues and fluids of affected animals as to the presence of a causal micro-organism led to no result. Cultural experiments likewise proved negative. Precipitin and deviation of the complement tests were carried out, using extracts of various organs as antigen. No precipitation was observed and in all the experiments with sera from affected or hyper-immune animals there was either no deviation of complement or no more than when sera from normal animals were employed.

Some experiments on the resistance of the rinderpest virus were performed and gave results somewhat contradictory to those of the earlier observers. The part played by the importation of hides from affected animals in the spread of rinderpest is of great importance and special precautions had always been taken in dealing with the importation of such hides from Asia and Egypt, but a danger always existed owing to the smuggling of fresh hides into the country from Turkey. The durability of the virus was ascertained by placing together skins from animals slaughtered at the height of an attack with common salt in the proportion of 1 in 10. A decoction of large pieces, scrapings of sections, and thin slices of the skins thus treated were fed five days after separation from the dead animal to two

susceptible animals, after ten days to another two, and after 15 days to another one. None of these animals became infected. Two susceptible animals likewise fed with products from a hide taken 40 days previously from an affected animal but stored in a dry shaded place and not salted remained unaffected.

Defibrinated virulent blood mixed with salt in proportion of 1 to 10 and stored in the dark at room temperature was injected after 48 hours in a dose of 10 cc. into a susceptible animal with negative result, while cattle injected after 48 hours with the same quantity of blood that had not been treated in this way reacted rather strongly. The untreated blood of affected animals kept in the dark at room temperature in vessels plugged with cotton wool usually lost its virulence after four to five days.

A small experiment showed that the virus is soon destroyed by putrefaction outside the animal body. Two susceptible young cattle were placed in a stall which had contained eight days previously a severely affected rinderpest animal and had not since been cleaned out. Both remained apparently healthy and the temperature normal for a month but they succumbed later after they had been injected with virulent blood.

In order to determine whether the incubation period was longer than the average in the case of the native breeds the daily temperatures of such animals used for virus production was taken and it was found that out of 37 cattle injected with from 1 to 50 c.c. virulent blood subcutaneously the shortest period was three days, and the longest 17 days; most of the animals had an incubation period of from four to six days.

The question whether rinderpest was communicable to sheep, goats and swine was of great importance inasmuch as these animals lived together with cattle in many places and might thus act as media for the spread of the disease, and also secondly it might be possible in this way to obtain an animal for the transportation of blood for the simultaneous inoculation which would be moreover free of cattle piroplasms. A sheep, a goat, and a pig were thus each inoculated subcutaneously with 1 c.c. of virulent blood. The temperature was taken twice daily and the general condition noted. Five days after the inoculation the sheep and goat showed a rise of temperature and in the course of the next six days loss of appetite, coughing, and discharge from the eyes and nose. Diarrhoea also set in finally in the case of the sheep. The disease ran a much milder course in the goat than in the sheep. Seven days after the appearance of symptoms both animals were slaughtered for post-mortem examination. This revealed congestion of the mucous membrane of the fourth stomach and intestine together with haemorrhages in some places. In the case of the sheep the changes were more marked than in the goat; there were small erosions on the buccal mucous membrane, and the mucous membrane of the respiratory tract was much redder than in the case of the goat. Diphtheritic changes were not observable. The other organs showed scarcely any changes. The pig showed no rise in temperature or change in condition after the injection. This result corresponds with those obtained by THEILER in South Africa after inoculation of virulent blood into pigs. [See, however, BOYNTON'S experiments, this *Bulletin*, Vol. 5. No. 1. p. 48.—ED.]

During the course of the outbreaks of rinderpest no cases of the naturally contracted disease were observed among sheep or goats although these animals were often placed together in the same sheds as infected cattle.

Some experiments on the value of gall inoculation were performed at one naturally affected centre and at the serum station. In the affected centre the draught and milch cattle were kept in yards while the other cattle were isolated a considerable distance away in a wood. 32 cattle which had not become affected in one yard were inoculated with gall taken from an animal at the height of an attack, the dose being 10 c.c. for adults, 5 c.c. for young animals and 3 c.c. for sucking calves. None of these animals became subsequently affected. The 92 animals isolated in the wood were similarly inoculated and of these five became affected and died after inoculation. These results appeared to be very good but it was decided to test the method on a number of animals used for furnishing virulent blood at the serum station. From these experiments it was concluded (1) that gall inoculation gave no specially good results in the case of the native grey breed; (2) the inoculated animals were subsequently liable to become affected with rinderpest contracted as the result of artificial infection or spontaneously as when placed among affected animals; (3) the animals given a protective inoculation with gall became affected with a mild form of the disease and the mortality was distinctly lower—9·09 per cent.—in the author's cases. There appeared to be no relationship between the severity of the symptoms and the quantity of virulent blood injected. As a result of these experiments gall inoculation was abandoned in practice and serum prepared for the eradication of the disease.

A very few experiments were made to ascertain the curative effects of drenching with creolin, the infusion of large quantities of normal saline solution, and serum. One rather severely affected animal recovered after receiving drenches of creolin, and another recovered after inoculation with hypertonic salt solution.

In choosing a site for the serum station a small island in the Black Sea was first selected, but, owing to the absence of a water supply, the station had to be removed to the mainland near the coast. Details are given with regard to the personnel and equipment of the laboratory. In order to obtain a supply of serum rapidly the author first of all endeavoured to obtain animals which had withstood the disease in affected centres. These were rather difficult to get as all suspected animals had been slaughtered. However, eight such animals were obtained in order to commence immunisation. In order to establish a ground immunity these animals were first injected with 10 c.c. of gall and 10 to 15 days later 1 to 100 c.c. of virulent blood. Later when serum was obtainable the animals were first inoculated with 10 to 45 c.c. of serum and 1 to 100 c.c. of virulent blood. The animals were further hyper-immunised according to either the rapid or slow method.

(a) Rapid method. In about 14 or 15 days each animal received from 1 to 5 litres of virus. After 12 to 14 days the first bleeding of 4 litres was taken, after another 5 days a second bleeding and after another 5 days a third bleeding of 4 litres each. After three weeks interval the animals were again given 1 to 7 litres of virus and 12 days later bleeding was repeated.

(b) Slow method. The animals were given 100 to 500 c.c. of virus, then at intervals of from 10 to 14 days three successive injections of 2 to 5 litres of virus in increasing quantities and 12 days after the last injection bleeding took place.

For the most part the rapid method was employed and after the establishment of a ground immunity up to 8 litres of virus were injected followed by bleeding after 12 days. The virus was given subcutaneously in most cases and sometimes intravenously.

Very full and clear details are given with regard to the manipulation of the animals used in the production of serum and the methods employed in the laboratory for getting the serum ready for issue. The total quantity of serum produced was 557,685 litres and by means of this product and the application of veterinary police measures rinderpest was eradicated.

Inoculation by the " serum alone " method was employed without exception. At the beginning only from 25 to 50 c.c. of serum, according to size of the animal, was inoculated subcutaneously, but later when more serum was available up to 100 c.c. was injected. Altogether 5,216 animals were treated with serum out of which 47 subsequently became affected (0·9 per cent.). Most of the latter, however, were affected soon after the injection, that is to say, during the incubation period. It was proved by experiments that the serum administered in doses of 40 c.c. conveyed a passive immunity which lasted about one month. The serum appeared to exercise a distinctly curative effect when administered in large doses intravenously into an affected animal.

With regard to the institution of veterinary police measures the active assistance of the military authorities was obtained in order to detect and control affected centres. Immediately the disease was diagnosed in a certain place a diseased zone was declared at a radius of 20 kilometres from the centre and a Commission, including a veterinarian, set up for the control of the disease in each zone. In the affected centres all movement of men, animals, and farm products was forbidden and at first slaughter of all infected and suspected in-contact cattle was ordered. Later when serum was obtainable only the affected animals were slaughtered and those showing high temperatures; all the others were inoculated with serum. The carcases of all dead or slaughtered animals were buried 6 feet deep without cutting the skin. With the approval of the Commission the flesh of suspected animals could be eaten by the inhabitants of the affected centres only. The hides of such animals were utilised after disinfection in lime water and drying. Rinderpest was declared to have been eradicated in a centre 40 days after the appearance of the last suspected case and after thorough disinfection with lime water, creolin, or carbolic acid. The dung was either burnt or covered with earth and lime. Every assistance was given by the peasants in carrying out these orders.

In order to guard against the introduction of rinderpest from Turkey a protective zone 30 kilometres deep has been set up. The cattle in these zones are under the control of veterinary officers and a register is kept of all oxen and buffaloes in the possession of the inhabitants and thus all movements and changes in the cattle population are recorded; all suspected diseases of cattle are immediately examined by subordinate veterinary officers. These measures enabled Bulgaria to eradicate and exclude rinderpest in the time of

peace but it is greatly feared that a calamity might occur again under war conditions, and more especially owing to the state of anarchy at present existing in Russia, whence rinderpest may spread most easily towards the west. [It is undoubtedly this danger to the cattle population of the Central Powers which has recently led to such prominence being given in their veterinary literature to rinderpest.—Ed.].

Ferraro (Giuseppe). **Perchè persiste la peste bovina in Eritrea.** [Why Rinderpest persists in Eritrea.]—*Moderno Zooiatro.* 1917. Sept. 30. Vol. 5. No. 9. pp. 215–216.

In this open letter to Zonchello (A.), whose observations on rinderpest in the above Italian Colony have already been referred to in this *Bulletin* [see Vol. 5, No. 2, pp. 127], Ferraro repeats the statement already published by him in 1912, viz., that the persistence of rinderpest in that country is essentially due to the so-called "simultaneous" method of inoculation adopted by the authorities in dealing with outbreaks. Rinderpest was imported into Eritrea in 1887–1888 and almost immediately afterwards caudal inoculation was practised as a method of vaccination. However, the disease neither spread very much nor was it of long duration, and during the Italian campaign in 1895–1896 it remained circumscribed in the Agrodat District. It reappeared in 1897 along the sea coast and owing to a repetition of the above inoculations the epizootic assumed a wide-spread character. In 1900 to 1901, before the Bloemfontein Conference had taken place, Conti had already tried the Kolle and Turner method at Asmara.

According to the author Zonchello was able to demonstrate that rinderpest could be eradicated from the country simply by the application of vigorous quarantine restrictions to affected centres; 142 centres originating from vaccinations performed at Naro-Carora were stamped out in this way. The great epizootic of cattle plague in South Africa is now commonly held to have originated from Eritrea.

The author further indicates that although the authorities might be excused for the adoption of vaccination methods during the conduct of military operations, there is no justification for their continuance during the present settled state of the Colony in view of the very good results obtained by Zonchello.

(c) Sheep-pox.

Manninger (R.). **Ueber Komplementbindungsversuche bei Schafpocken.** [Complement Tests in Sheep-pox.]—*Cent. f. Bakt.* 1. Abt. Orig. 1917. Nov. 15. Vol. 80. No. 4. pp. 190–195. With 3 tables.

In the case of human small-pox the majority of workers have found that the blood serum of affected subjects possesses complement-binding substances when placed in contact with small-pox material. However, it was noted that the antigen differed greatly according to its origin, for while the serum and various organs of affected human subjects only in rare cases furnished appreciable antigen the crusts and pustule

contents of the skin lesions almost always gave positive results. Complement binding has also been obtained by several authors after the use of calf lymph as antigen but some other workers assert that lymph is of no use as antigen. KLEIN (1914) states that this can be accounted for by the fact that sufficient virus is not present in every lymph.

In the case of cow pox JOBLING (1906) and also SHIGA (1910) showed that the serum of vaccinated calves contained amboceptors when placed in contact with fresh extract of pustules. On the other hand HELLER and TOMARKIN (1907) could observe no binding of the complement in similar circumstances.

In this article the author describes experiments performed in order to determine the existence of complement-binding amboceptors in the sera of sheep artificially inoculated with sheep-pox, and sheep suffering from the naturally contracted disease. Preliminary experiments showed that the best materials for furnishing antigen were emulsions of the crusts, formed by the desiccation of the exuding lymph on the surface of incised pustules, or of the crushed up pustules. Emulsions of infected pustules and of skin seldom contained appreciable antigen. In his further tests the crusts of dried lymph were invariably employed and these were obtained as follows. A sheep was inoculated intracutaneously in several places with a drop of sheep-pox lymph and nine days after inoculation the swellings were incised and the lymph obtained used for further ovination. The animal was then bound with an aseptic layer of cloth and the lymph which later exuded dried to form yellowish-brown crusts which were then crushed up and emulsified in the proportion of 5 grammes to 50 c.c. with normal saline solution, containing 0·5 per cent. carbolic acid, in a shaking machine. The emulsion was then filtered through three layers of muslin. This filtered emulsion was then titrated so that a dose of 0·02 c.c. contained the necessary amount of antigen for each haemolytic system.

In the case of four sheep inoculated with a drop of sheep-pox lymph into the ear the first indication of complement binding was obtained in from 10 to 31 days after the inoculation, or 3 to 23 days after the onset of symptoms; this phenomenon was most apparent in from 20 to 31 days after inoculation, or 13 to 19 days after the onset of symptoms, and remained distinct for 16 to 20 and appreciable for 35 to 48 days after the first appearance of the positive reaction.

In the case of four susceptible sheep placed in contact with affected sheep an appreciable reaction was obtained 9 days after the first appearance of skin lesions; 9 days later the reaction was distinct. The sera taken from 17 sheep in the scene of an outbreak gave distinct reactions in cases where the animals showed papules and crusts, while a somewhat less distinct reaction was observable in cases where the skin lesions had become cicatrised.

In the sera of healthy sheep no complement binding substances could be detected.

MISCELLANEOUS.

JONES (F. S.) & ARNOLD (J. F.). **Staggers in Sheep in Patagonia.**—*Jl. Experim. Med.* 1917. Dec. 1. Vol. 26. No. 6 pp. 805-823. With **4** plates comprising 13 figs.

The above two workers from the Department of Animal Pathology of the Rockefeller Institute for Medical Research investigated, at the instigation of a sheep-farming company of London, a nervous disorder of sheep which has become more prevalent during the past few years throughout portions of Patagonia. The disease is known under a variety of names—staggers, temblique, loco and huecù—and appears to be widespread for it exists throughout the pampa at least as far north as the Chubut Valley and extends southward to Descado and from the eastern boundary of the pampa to the Andes. The incidence varies greatly with the condition of the food supply. When there is a liberal amount of grass the number of cases is small but after a long continued drought, when the fine grass supply is short, the number of sick animals is large. The mortality varies considerably, and young sheep seem to suffer most. The disease is not confined to the ovine species alone; horses and cattle succumb readily to it. A disease similar to staggers was studied clinically in detail by ACOSTA (1914) and experimental feeding of a coarse tuft pampa grass (*Poa denudata*) to a horse, bullock and two sheep resulted in the production of definite nervous symptoms. His experiments were not controlled and inoculations were not attempted. Symptoms were said to develop in within 12–24 hours after the first feeding.

The authors then proceed to discuss the incidence of the disease amongst sheep, especially lambs, according to their age and the dryness of the season, from the reports of farmers. Peculiar neuro-muscular symptoms are described and well illustrated in the plates. Details are also given of a number of experiments performed which appear to prove quite conclusively that the disease cannot be transmitted by inoculation, but is easily set up by feeding with the coarse tuft coiron or pampa grass which grows in large quantities on the pampa at altitudes of from 500 to 1,500 ft. These tufts vary from 16 to 60 cm. in diameter and may reach a height of 40 to 50 cm. On a certain estancia on which staggers was prevalent there were three low paddocks situated at an altitude at least 200 or 300 ft. lower than the pampa; no matter how sparse the herbage became in these paddocks the disease never developed in the sheep kept there. When removed to the mixed pampa paddocks, however, staggers broke out, thus corroborating the results of the experimental findings. Horses brought on to the pampa from other districts often became affected with staggers in 24 hours. It seemed very unlikely that the disease could be a so-called "deficiency" disease inasmuch as THEILER, GREEN and VILJOEN failed to set up symptoms of avitaminosis in horses, cattle, and sheep feeding on a diet of 10 parts of polished rice and 1 part of autoclaved hay for long periods.

The prophylaxis of the disease would seem to lay in the direction of the eradication of the coiron grass but this would be a task of great magnitude as the grass is abundant from the foot hills of the Andes to the eastern boundary of the pampa. During the summer months when the grass is seeding the prevailing winds are from the west and

it is not unusual for them to blow steadily for 3 or 4 days and attain a maximum velocity of 84 miles an hour. Even if this grass was eradicated from the western portions of the country it would soon re-appear. Burning off a portion of the land failed to kill the grass. Unless another grass could be substituted for it its eradication might cause considerable loss inasmuch as old sheep become tolerant to it and eat it without harmful effects. Probably during periods of drought many animals are dependent upon it for nourishment, and thus without the substitution of some other bulky food the losses from starvation might well equal the losses occurring from staggers. The authors draw up the following conclusions as a result of their observations and experimental work.

"1. Staggers is a non-infectious disorder affecting horses, cattle, and sheep.

"2. The disease is characterised by weakness, muscular twitching, irregular movements of the head, stiffness of the limbs, and transient motor paralysis, accompanied with spastic spasms on excitement. There is also a derangement of vision and conjunctivitis.

"3. The postmortem lesions are not characteristic.

"4. We readily produced the disease by feeding susceptible sheep on a coarse tuft grass commonly known as coiron or pampa grass (*Poa argentina*).

"5. The time required to produce definite symptoms by feeding the grass varied. Two animals developed typical staggers after two feedings; in another instance a period of 21 days of feeding was required. The average time for the production of unmistakable symptoms in our experiments was 10 days.

"6. Many sheep recover from staggers spontaneously. A complete change of diet will usually effect a cure within 2 weeks.

"7. Older animals that have pastured for long periods on lands where the grass grows become tolerant and are rarely affected with staggers.

"8. The grass is toxic to sheep at all seasons of the year. We fed late winter and early spring grass and grass in flower, and produced staggers in every instance. The young green grass is as toxic as any edible portion of the plant."

Cross (H. E.). **A Note on Jhooling in Camels.**—*Agric. Res. Inst. Pusa.* Bull. No. 72. 2 pp. With 2 plates comprising 4 figs. 1917. Ca'cutta: Supt. Govt. Ptg. India. [Price As. 2 or 3*d.*]

Jhooling or jhoolak is described as "a contagious disease of camels—manifesting itself in the formation of local tumours, hot and painful, of a fibrous character, and terminating in suppuration and raw patches."

The disease is widely distributed throughout the Punjab; it is not so common in the Lahore District as in the Jhelum and Rawalpindi Districts. It usually occurs in the cold weather, but is met with occasionally in the hot weather. The causal organism has not yet been isolated but the author suggests that it is probably a fungus. The disease cannot be communicated to horses, buffaloes and cattle by placing them in contact with affected camels, and the lesions cannot be set up in these animals or in dogs, guinea-pigs, or rabbits by inoculation of emulsions of the lesions and by rubbing portions of the lesions on to the intact or scarified skin. On the other hand, rubbing of this material on to the scarified skin of healthy camels sets up the disease after a few days, and in one case only the disease developed after rubbing the

material on the intact skin. Healthy camels kept in contact with affected camels contract the disease rapidly.

The lesion is first seen as a hot, hard, painful swelling varying from 1 to 5 inches in diameter and usually situated on the neck, hind quarters, or scrotum. After a few days the swelling becomes very irritating, and when situated on an accessible part of the body the camel gnaws at it with its teeth, leaving a raw patch. Suppuration takes place in all cases after a certain interval, and finally the wound heals leaving a small white patch which remains visible for several months. The diseased animal is usually affected with several lesions, which cause loss of condition. When situated on a part that comes in contact with the saddle they render the animal useless for work.

The lesion is composed of fibrous tissue with suppurating centres, the pus showing streptococci but no staphylococci. No lesions were observed in the internal organs.

As regards treatment the author specially recommends the application of a strong red iodide of mercury blister, which should be washed off with soap and water three days afterwards. The diseased areas are then excised and finely powdered potassium permanganate well rubbed in. Three dressings at intervals of four days are usually sufficient. Sometimes good results are obtained by excising the lesion and then applying pure carbolic acid. The wounds are then thoroughly washed with water on the following day and treated with the so-called "black wash."

As a preventive measure affected animals should be immediately isolated and the healthy animals divided up into lots and not allowed to intermingle; these are carefully examined and if more cases are discovered they should be isolated at once. The disease spreads very rapidly among camels and causes a great amount of trouble. No camels should be bought if small hard white spots are noticed on the skin, for they undoubtedly represent healed-up jhooling lesions.

HOLBOROW (A. G.). **The Restraining Influence of Cyanide upon Oxidation in Arsenical Dips.**—*Rhodesia Agric. Jl.* 1917. Dec. Vol. 14. No. 6. pp. 733–737.

In this preliminary report the author describes a few experiments performed with the object of finding some means for inhibiting the formation of arsenate of soda from arsenite of soda in dipping fluids. The cause of this oxidation is apparently quite unknown. Micro-organisms have been suggested to play some part but the oxidation is not prevented by the addition of strong disinfectants such as formalin, corrosive sublimate, and carbolic acid. One method of preventing rapid oxidation is to agitate the dipping fluid in the tank by passing cattle through it at regular and frequent intervals. If dipping fluids are allowed to rest undisturbed they are liable to undergo complete oxidation very soon. It was found that the oxidation was not prevented by sterilisation of the liquid in an autoclave, boiling it for half-an-hour, or by passing the original dipping fluid through a bacterial filter. However, in one month after the addition of as small a quantity as 0·005 per cent. of potassium cyanide the oxidation had increased only 13 per cent., whereas the untreated dip showed oxidation to the extent of 83 per cent. in 11 days.

TRIBONDEAU (L.) & DUBREUIL (J.). **Nouveaux colorants pour microscopie dérivés du bleu de méthylène.** [New Stains for Microscopical Work derived from Methylene Blue.]—*C. R. Acad. Sci.* 1917, Apr. 2. Vol. 164. No. 14. pp. 551–553.

Inasmuch as considerable difficulty is experienced at the present time in obtaining satisfactory reagents for staining by the Romanowsky method in laboratories, the following short account by the above two authors of some products devised by them and already described in various other journals is translated almost literally; these products have been reported to us to have given highly satisfactory results.

There are numerous methods for causing the appearance in a solution of methylene blue of the two extremely useful derivatives for microscopic staining, viz., methylene violet and methylene azur. All these methods depend upon the action of an alkaline substance, viz., silver oxide in the case of Borrel blue, potassium carbonate in the case of Unna's polychrome blue, sodium borate in the case of Manson's blue, etc.

But, hitherto, no method of isolating methylene azur and violet has been published, and it is thus that we are dependent for these products and the staining solutions derived from them upon the German firms to which Giemsa has given his secret technique for the manufacture of azur. . . . We succeeded in manufacturing methylene azur and violet in a very simple manner:—Take a 1 per cent. solution of pure medicinal French methylene blue in distilled water, add 5 to 10 per cent. of liquid ammonia, and after mixing in a glass vessel heat on a water bath until the latter boils. An abundant precipitate is formed; filter hot on folded filter paper. The filtrate is allowed to evaporate in a large photographic dish placed in the incubator at 37° to 40° C. The residue after desiccation, collected by scraping and then powdered, is practically pure methylene violet.

As regards the precipitate a little is found on the filter paper but the bulk of it remains adherent to the walls of the flask. The filter paper and unstoppered flask are allowed to remain in the atmosphere for at least 24 hours, or, preferably, in the ice chest, in order to avoid evaporation of the moisture. Under these conditions the precipitate becomes coloured more and more intensely dark blue. When thus completely changed distilled water is added in which it then easily dissolves. Filter and treat this new filtrate as already described in the case of the preceding one. A second powder is thus obtained, viz., methylene azur.

The procedure, if properly carried out, should give approximately equal quantities of *ammoniated violet powder* and *ammoniated azur powder*.

These powders serve for the preparation of three staining solutions: (1) an aqueous solution of azur; (2) an aqueous solution of azur and violet called ammoniated *polychrome blue*; (3) an alcohol-glycerine solution of azur and eosin analogous to Giemsa's mixture for which the term *azéo* is proposed.

The *aqueous solution of azur* is made by dissolving 1 gramme of ammoniated azur in 100 c.c. of distilled water. This is utilised for staining liquids or organic products in the fresh state, between slide and cover glass. It is sufficient to mix 1 drop of stain with 1 drop of the product to be examined, cover with a cover glass border with some cement substance, and examine with artificial light. The staining process is progressive and then regressive. Good preparations are thus obtained of the cells contained in morbid extravasations and of the amoebae of dysenteric mucus. However, the results vary with the chemical reaction of the products studied.

Ammoniated polychrome blue is a mixture of 1 per cent. watery solutions of ammoniated azur and violet. The optimum proportion of the two constituents is ordinarily 1 part of the blue solution to 3 parts of the violet solution. This proportion is fixed by trial taking as a criterion the results obtained by staining sputa. In our routine practice we have substituted this mixed blue for carbol thionine and Unna's blue. It has the advantage of not decomposing like these stains. It is suitable for all simple bacterial staining but it is especially valuable on account of

its remarkable and specific metachromatic properties for the examination of sputa and all organic pathological fluids (pus; secretions from the urethral and buccal ulcers; the deposit after centrifugation of pleural fluid, cerebro-spinal fluid, etc.). The method of use is very simple. In the case of sputa the technique of BEZANÇON and JONE (with Unna's blue) serves quite well on the condition that fixation is carried out with alcohol and not with chromic acid. Other smears are fixed in alcohol, stained for 30 seconds to 1 minute, washed and dried. It sometimes proves useful to differentiate rapidly by means of absolute alcohol. Examination by means of artificial light is indispensable.

Azéo is made up of two solutions, viz., of 1 per cent. ammoniated azur and 1 per cent. French eosin, in each case in absolute ethyl alcohol containing a quarter of its volume of glycerine (alcohol 75, glycerine 25). The blue solution is poured gently into the eosin solution until they become neutralised and this requires a mixture of about equal parts of the two solutions. This mixture is allowed to stand for several days in order to give time for the azur and eosin to combine. An excess of the alcohol glycerine solution of azur is then added (about 2 parts to 8 parts of the above mixture). Staining with azéo is carried out in troughs as in the case of Giemsa. The dilutions (on an average 1 drop in 1 c.c. of distilled water), time and method of staining, and the various uses of the celebrated German stain are applicable to this stain with equal if not superior results. The fixation of the preparation to be stained can be carried out, as in the case of Giemsa, either by means of absolute alcohol or by means of the stain itself diluted with an equal volume of absolute alcohol. But the best results are obtained by fixing with bieosinate.* One is thus able to employ Pappenheim's panoptic method, but with bieosinate instead of May-Grunwald and azéo instead of Giemsa, and consequently with two French stains.

REPORTS.

NYASALAND PROTECTORATE. **Annual Report of the Department of Agriculture for the Year ended 31st March 1917.**—19 pp. f'cap. Zomba: Government Printer. [Price 6*d.*]

The following notes with regard to the state of veterinary affairs in the above territory occur in the abridged report of the Director of Agriculture [MCCALL (J. Stewart)]. (pp. 4–5.)

"The southward spread of rinderpest in German East Africa has for the present depleted the Department of its entire veterinary staff, so it is impossible this year to include the usual report of the Veterinary Division.

"Dipping is now established in the Shire Highlands, and the general health of stock shows much improvement.

"Demodectic mange has been stamped out in most herds, and a small new centre of the disease in Marimba district was effectively dealt with by the slaughter of some thirty head of native owned cattle.

"It is interesting to record that when the dangers of the disease were explained to the natives they carried out veterinary recommendations without compensation.

"The Government Entomologist has, after most thorough investigation, mapped out the tsetse areas on the Shire between Matope and Liwonde. He can trace no fly areas adjacent to the Zomba-Blantyre road, where a considerable number of cattle contracted trypanosomiasis. No further cases have been reported on this road during the year.

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*[The manufacture of the above stain was described at some length by the above authors in *C. R. Soc. Biol.* 1916. Apr. 1. Vol. 79. No. 7. pp. 282–287.]

"On the Zomba-Liwonde road, 6 miles from Zomba, one case of trypanosomiasis occurred in the vicinity of the Naisi stream, but this is possibly caused by a stray infected fly or flies, and likely to recur in odd cases at any point within 20 miles of the Shire River (Matope-Fort Johnston).

"An outbreak of trypanosomiasis occurred in south-east Mlanje. The Government Entomologist, after thorough search, found no *Glossina morsitans* but *Glossina brevipalpis* was found near Sayama Estate, and is probably responsible for the disease.

"The distribution of *G. brevipalpis* will receive further consideration whenever the services of the Government Entomologist are available. Meantime stock-owners in the vicinity have been advised of the areas in which the fly were found."

Southern Rhodesia. **Report of Committee of Enquiry on African Coast Fever, Quarter-Evil and Epizootic Diseases of Cattle.**—38 pp. f'cap. 1917. Salisbury: Government Printer.

The work entrusted to the Committee of Enquiry was to enquire and report on (1) the origin of and circumstances attending recent outbreaks of African Coast Fever, (2) the adequacy of the measures taken hitherto to prevent and suppress African Coast Fever, and to suggest other measures, and (3) the circumstances attending the recent outbreaks of quarter evil, and (4) to consider measures for the control and prevention of epizootic diseases of cattle.

With regard to the first of these headings the Commissioners failed to establish "anything approaching definite proof as to the cause of the recent outbreaks." The questions detailed under the second heading resolved themselves mainly into the matter of tick eradication by enforcement of dipping regulations with dips maintained at efficient strength. The advantages that would ensue through the adoption of general dipping were agreed upon unanimously by the witnesses examined. Consideration was given to the best methods for maintaining dips at the strength necessary for killing the transmitting agents of African Coast Fever. Dipping at seven-day intervals was believed to be sufficient for killing off all ticks except the bont and bont-legged varieties which are not vectors of the disease. In such cases the veterinary bacteriologist was of opinion that "while one tick might be present by accident the presence of 10 ticks would indicate negligence." "Wherever dipping of cattle is required the presence of 10 engorged female ticks on an animal should be punishable." The means of providing financial help for the erection of dipping tanks were discussed, together with the fees to be levied on natives for their use.

Miscellaneous questions such as those relating to veterinary surgeons, cattle inspectors, restriction of cattle, permit system, cattle dealers, branding, fencing, and veterinary research were also enquired into. In the draft of the proposed Ordinance it was recommended that all owners of cattle in areas in which the "Compulsory Dipping Ordinance of 1914" is in force, and from and after a date to be fixed by the Administrator, all owners of cattle in areas other than temporarily exempted native reserves shall be required to clean their cattle. A scale of punishments for being in possession of tick-infested cattle is laid down.

Shortly after the fall of heavy rains in the Bulalima-Mangwe district in November 1916, several outbreaks of blackquarter occurred attended by considerable loss of cattle. Since that date the disease has spread

to a large number of herds in Matabeleland. These outbreaks are regarded by some as the first occurrence of the disease in the country, but most probably it existed before the date of the European occupation and isolated cases of mortality from this cause in recent years were attributed to snake bite.

In the concluding pages the Government Veterinary Bacteriologist (BEVAN, Ll.E.W.) appends a report on the necessity for veterinary research in Southern Rhodesia. In the past this has been almost entirely neglected by the administrative authorities but Bevan elaborates data showing the advantages which would accrue, judging from the results obtained in British East Africa and the Union of South Africa, from the erection of a laboratory well equipped with personnel and materials for routine and research work.

"It is generally believed that the future prosperity of Rhodesia chiefly depends upon the progress of the pastoral industry, and it has been freely asserted that the country is pre-eminently suited for stock. It is, therefore, somewhat disconcerting to find that after more than 25 years' European occupation 95,000,000 acres of land are carrying little more than one million head of cattle, the great majority of which are of inferior type, and in normal times too small and too slow to mature to be suitable for the meat markets of the world. This unsatisfactory state of affairs may be chiefly attributed to (1) *epizootics, e.g.*, rinderpest, contagious bovine pleuro-pneumonia and East Coast Fever, which have decimated our herds; and (2) other more *obscure diseases* which reduce the health and development of our domestic stock."

Research in connection with the above problems is thus of unquestionable necessity. Moreover, the authorities should be on their guard against importing disease from without, especially as there is a distinct risk of rinderpest making its way down into the country from British East Africa.

Details with regard to the staff required and salaries are suggested.

SOUTHERN RHODESIA. **Report of the Government Veterinary Bacteriologist** [BEVAN (Ll. E. W.)] **for the Year 1916.** 17 pp. f'cap. MS. Report received 1918. Feb. 1.

In this MS. report BEVAN gives an account of a fairly considerable amount of routine work and a series of interesting observations performed almost entirely by himself and with very niggardly support from his Government. The work of the laboratory is stated to have been maintained at a cost, exclusive of salaries, of a little over £300, and this appears to the reader to be out of all proportion to the importance of the contagious diseases of animals in this large tract of territory.

Out of over 2,500 smears and specimens from the field examined at the laboratory 120 smears revealed the presence of the organisms of East Coast Fever, 125 the parasites of other diseases, and 33 specimens of serum gave positive results as to the presence of contagious abortion in cattle.

The report contains a summary account of some of the results of the experimental work performed.

Horse sickness. In the absence of suitable animals for experiment the Commandant General had placed at the disposal of the author horses recently imported as remounts for the Police. Eighteen such horses were inoculated by THEILER'S method in 1915, and in the year

under report 156 horses were also dealt with in the same manner with a loss of 20 animals. This result is considered to be very satisfactory although the resistance of the inoculated animals to natural infection had not been determined at the time this report was written. Three horses were taken, two of which had been previously inoculated, while one untreated horse served as a control; each was injected with virus taken from an animal that had died as the result of inoculation. The control horse died on the sixth day while the two vaccinated animals remained unaffected. Another police horse which had been inoculated in October 1915 was again inoculated in September 1916 with virulent blood; no reaction followed. Mules inoculated according to THEILER'S method have proved resistant to horse sickness in most districts of Southern Rhodesia. As immunity towards one strain of virus does not necessarily afford protection against infection by another it is anticipated that when inoculated police horses are distributed throughout the country many of them may become infected with a strain of virus peculiar to the district to which they are sent. There is, however, some evidence to show that the mortality in such cases is considerably less than in the case of uninoculated animals provided they are rested during the attack. During the year 1912–1913, 45 out of 207 police horses died of horse sickness, and in 1914–1915 41 died out of 193. It was feared that the horse sickness season at the time of writing would be exceptionally severe owing to the early and continuous rains.

"*The Plasmoses of Cattle.* More general application of the principle of 'short interval' dipping has, to a large extent, reduced the losses due to these diseases, and at the present time there are farms to which cattle imported for the improvement of local herds can be introduced with safety without inoculation, and upon which the improved progeny grow up free from the tick-borne diseases. Although the advantages thus derived are great it must be remembered that the dipped areas in the country are far exceeded by those where the principle is not carried out and ticks and the diseases transmitted by them are prevalent. Thus in practice there would appear to be three stages in the development of a herd; the first, or pioneer stage, when imported animals cannot be used for the improvement of the nucleus of native cattle unless inoculated, and when a heavy mortality of young stock must be expected from redwater and allied diseases; a second stage, when by systematic dipping the veld becomes tick-free, and imported stock can be introduced with impunity and the young progeny grow up and thrive free from disease; and lastly, the stage when the animals bred upon such areas being susceptible to tick-borne diseases cannot be exposed to tick-infested veld so that the market for them becomes restricted. Therefore, in spite of the progress and advantages of systematic dipping there are certain disadvantages associated with it until the system becomes universally practised. In the meantime there remains the necessity for a satisfactory method of inoculation for the protection of imported bulls exposed on infected veld, and of young stock born upon tick-free farms, in order that they may be disposed of with safety beyond the limit of such areas. During the past ten years efforts have been made to discover a satisfactory means of conveying immunity, but experiments have unfortunately been handicapped by the extreme cost of experimental animals which have of necessity to be imported from countries free from these diseases; but from time to time consignments of cattle have been imported by progressive breeders anxious to improve the class of cattle in this country and the Veterinary Department has been called upon to inoculate them to the best of its ability. Thus in 1911 ninety-four bulls were imported and were inoculated with a loss of 5 per cent. only, but many of these were inoculated with a virus supplied from the South and did not prove immune when exposed to natural

conditions. Others, inoculated with a local strain of virus, suffered more severely at the time of treatment, but subsequently proved immune.

The utility of such animals is somewhat impaired during their first year in the country, but record of many of them are available and show that some of them have taken honours in the show ring, notably the bulls "Baronet" and "Aeriel Knight," and a considerable number have been responsible for as many as two to three hundred progeny, of improved type and bearing the impression of the sire. Again, in 1912 about sixty-eight animals were imported from overseas, twenty-five home bred animals died, but it should be pointed out that their owners had been previously warned that such stock was unsuitable for inoculation on account of age, soft condition, pregnancy, or in-breeding, and the inoculation was undertaken under protest. Nevertheless, in spite of the heavy mortality the survivors have proved a profitable investment, more than paying for the losses, the progeny of some of the inoculated females having been sold for three figures. In 1913 ninety-four cattle from Great Britain were inoculated with a loss of twenty-seven; this mortality which took place during the absence of the Bacteriologist was probably due to some unaccountable exaltation in the strength of the virus used, and it was thought wise to suspend further inoculations until the process could be placed upon a safer basis. Since then no privately owned imported stock has been accepted for inoculation until October last, when eleven animals were received for treatment at the Laboratory, the inoculation of which is not yet completed. During the interval, however, two small consignments of young cattle from England have been imported for experimental purposes and different strains of virus have been tested with the result that it is now hoped that given suitable animals and proper accommodation, the principle can again be applied upon a large scale. It has been abundantly proved that to obtain the best results, animals submitted for treatment should not be too fat or pampered, or too highly bred, and should not exceed fifteen months of age. The mortality among such animals should be insignificant and recovery from the slight set-back caused by the operation should be rapid. Now that Rhodesia has with her limited supply of high-grade animals entered the meat markets of the world, no time should be lost in bringing up the bulk of her stock to the same standard of excellence as that exhibited by the sample consignments.

"*Trypanosomiasis.* In January it was reported to the Veterinary Department that a large number of pigs were dying from some unknown disease at two farms on the Northern border of the Umfuli River, In one herd of one hundred and fifty as many as twenty pigs had died, and a large number at the time were showing symptoms of the disease, and in the second herd of about fifty pigs five had died and many others were severely sick. Examination of smears submitted from sick animals revealed large numbers of trypanosomes of pecorum group, but differing slightly morphologically from the trypanosome commonly met with in cattle in the Hartley district, notably in the fact that the body appeared more flexible and the undulating membrane more highly festooned, so that in fair specimens it was afterwards possible to distinguish the two by microscopic examination. One particular feature of interest in connection with the outbreak was that although the Hartley district has been known since the early days to be an area infested by *Glossina morsitans*, no tsetse fly had ever been encountered in the particular position where this outbreak was occurring and there was every reason to fear that the disease might be transmitted by biting flies other than the tsetse, or by some other means. Such a possibility was alarming, since the experience and research of the past ten years has led to the conclusion that as far as the trypanosomiasis of animals in Southern Rhodesia is concerned, it is seldom if ever transmitted from sick to healthy in the absence of the tsetse fly. That certain forms of trypanosomiasis can be so spread is admitted, and examples have been met with in neighbouring territories; but it would appear that in such instances certain conditions are necessary, which may almost be laid down as axiomatic, viz., an original source of infection, generally an animal infected by the tsetse fly; an abundance of trypanosomes in the peripheral blood of the animal; very close contact between sick and susceptible animals; a vast number of transmitting

agents, and finally certain climatic conditions of warmth and humidity. These essential conditions are seldom if ever met with in Southern Rhodesia. In order to study this disease of pigs one or two infected animals were sent to the laboratory. With the virus thus supplied experiments were undertaken to ascertain the nature of the parasite and its infectivity to domestic stock, its transmissibility other than by the bite of the tsetse fly, and to obtain as quickly as possible a means of treating and preventing the disease caused by it. It was found that this disease could easily be transmitted from pig to pig by artificial inoculation of small quantities of blood, giving rise to a disease rapidly fatal, killing untreated animals in less than thirty days. Small laboratory animals did not become infected even by repeated doses of virus from a natural case, and sheep and cattle exhibited a marked degree of resistance. Transmission experiments undertaken proved negative and a natural experiment showed that infection from sick to healthy was not readily effected by biting flies. At the Laboratory sick and healthy were closely stied together and were continually pestered by swarms of stomoxys which were noticed to pass from one to the other. Nevertheless no infection of the healthy took place except by means of the syringe. Thus the manner in which so gross an infection can have been brought about under natural conditions remains to be shown. The problem of greatest importance to be solved was to find a means of protection and treatment. For several years the trypanosomiasis of Hartley cattle had been found to yield to massive doses of antimony and arsenic. But the former drug had to be carefully injected into the vein, because if it made its way under the skin it gave rise to severe abscesses and sloughs; it could not therefore be applied in the same way to pigs, and, further, its beneficial effect upon bovine animals was largely due to their peculiar tolerance to antimony. It was necessary therefore to discover a form of the drug which could be administered to pigs without harmful effects and this was finally met with in a combination of emetic and arrhenal which was applied with most favourable results; but it has to be admitted that in the great majority of cases a complete cure was not effected but merely, as in cattle, a state of tolerance established, enabling treated animals to live in apparent health until adverse conditions reduced their resistance and once again the trypanosome re-asserted itself and produced its harmful effects. Thus in one herd the results were most favourable and the disease was arrested so that the great majority of animals could be fattened off and disposed of, but in the second herd, where the owner failed to supply an adequate diet, the good results of the treatment were but temporary and most of the animals died.

"During the year a few experiments have been conducted in connection with other forms of trypanosomiasis; the appearance of *T. brucei*, var. *rhodesiense* in donkeys working at the junction of the Umfuli and Umnyati rivers indicates that the distribution of this form of infection is greater than was supposed, and in view of the possible transmission of the parasite to man by *G. morsitans* and the invariably fatal disease set up, experiments were conducted with remedies for which success has been claimed by workers in European laboratories. The most important of these was that recommended by Daniels and Newham in the *Lancet*, January 8th, 1916, p. 102, who claim to have permanently cured a case of human infection with *T. rhodesiense* by subcutaneous injections of 30 minims of Martindale's solution (injectio antimoni oxidi) given subcutaneously twice a day.* This drug, when applied to pigs infected with the small trypanosome of the *pecorum* group, in the dose recommended, produced no appreciable effect. Martindale's solution is supposed to contain one-hundredth of a grain of antimonious oxide in 1 c.c. of glycerine and water equal parts. Nevertheless infected pigs and sheep received quantities containing as much as 0·5 gm.

* Mr. Bevan is not quite correct here. There was no claim to permanent cure. The preparation was recommended as one of antimony that could be injected under the skin without causing necrosis, abscess, or severe pain. It was tried in one instance and the trypanosomes had been absent for a fortnight when the communication was sent to the *Lancet*. "Possibly the preparation may give as satisfactory results as atoxyl." [See also *Tropical Diseases Bulletin*, Vol. 7, p. 106].—[GEN. ED.].

of antimonious oxide without harmful effect, but without beneficial results or apparent influence upon the course of the disease. An ox naturally infected received up to 2 gm. of the salt in suspension but the parasites did not disappear from its blood and the animal died from trypanosomiasis six days after the last injection. The results with this agent were very disappointing, as difficulty was being experienced by the military authorities in passing animals through the fly belts of Northern Rhodesia on their way to the Northern Frontier of operation, mules becoming infected and useless for transport work and fly-struck cattle proving unsuitable for human consumption. The use of tartar emetic although beneficial, had its disadvantages owing to the difficulty in application and dangers of local injury, and it was hoped that if the tri-oxide of antimony was equally effective and could be applied subcutaneously in the form of a cream, it might take its place with advantage. Unfortunately experiments showed that the results obtained were by no means as good as those following the use of emetic, and the treatment could not be applied in practice.

"*Dipping of sheep.* Reference may be made to an experiment carried out at the request of the Chief Veterinary Surgeon to ascertain the effects of 'short interval dipping' upon sheep and lambs. A small flock made up of thirty nine sheep and lambs of mixed breeds, the majority being half-bred persians, but six of long-woolled varieties, were purchased for the purpose. All these animals were in a most emaciated condition and suffering from fluke, wireworm, tape-worm and the nodular worm of the intestines. It was with difficulty that they were driven from the farm from which they were purchased to the laboratory. On the 5th February dipping was commenced in Cooper's dip, one in three hundred strength, in which they were immersed three times in ten days: the strength of the dip then being increased to one in two hundred and fifty. Dipping was carried on regularly twice a week in this strength until the 16th April, making nineteen dippings in all. During this period ten animals died, viz., four sheep (one woolled) and six lambs, these being the weakest of the flock. The rest of the flock improved markedly in health. The experiment was then discontinued but the result is still apparent in that the survivors are still alive and in the best of condition, and the ewes have given birth to lambs which have thrived and grown out in spite of the fact that most of them have been born during the dry season. The experiment was originally intended to determine to what extent small stock could be dipped with safety in areas which have to be freed from African Coast Fever.

"It is probable that such drastic measures could not be applied in a damp atmosphere, or to woolled varieties because of the damage to the fleece, but in practice this would not be necessary. The experiment, however, has gone further in affording support to the observation of officers in the field that dipping exerts a beneficial action upon sheep infected with worms. The results have been so remarkable that when opportunity arises further experiments of a more exact nature will be carried out."

Contagious abortion. Owing to the local peculiarities of the country the author is not certain of the best means of dealing with it. Besides the application of quarantine restrictions, isolation of affected animals, and removal of the bull from the herd vaccination was practised in several instances. The method of vaccination apparently consisted in the inoculation of large doses of dead cultures and favourable results were alleged to have been obtained after the use of this method by officers in charge of the outbreaks. The issue of a living vaccine is considered to be unsafe in Southern Rhodesia where the means of transport are often primitive and where it is often impossible to tell whether an animal is pregnant or not. Experiments are said to have been conducted to test the relative value of (*a*) living vaccine, (*b*) carbolised vaccine, and (*c*) vaccine killed by heat, from which it was found

that a vaccine of *B. abortus* killed by extreme heat gave rise to a reaction almost as great as that produced by a living vaccine, but of a somewhat shorter duration. The reaction was apparently measured by the agglutination titer of the blood of the experimental animals, but, as the author himself admits, "agglutinins are not identical with immunity although they do to a great extent run parallel to it."

[In support of his contention that good results may be obtained by the use of dead vaccines the author says: "As the result of experiments conducted by the Board of Agriculture in England, the protective inoculation of cattle against contagious abortion has proved successful when the vaccine has consisted of 'massive' doses of living organisms, but equally good results have not been obtained when vaccines have been killed by heat. On the other hand, a certain firm of repute continues to issue a dead vaccine and claims good results from it." It need hardly be pointed out that one usually weighs evidence as to the value of any product in the treatment of disease by a critical examination of published results, and not by ascertaining its saleability through commercial concerns.—ED.]

Various. A kaffir onion known as "Chitupatupa" and the root of a bush known as "Mutsura" used by natives for poisoning pools when catching fish were suspected of having set up outbreaks of poisoning among cattle. Feeding experiments proved that these materials were harmless when fed in comparatively large doses. An outbreak of tuberculosis in a herd is briefly discussed.

UGANDA PROTECTORATE. **Annual Report of the Department of Agriculture for the Year ended 31st March 1917.**—48 pp. f'cap. 1917. Entebbe: Government Printer. (Report of the Chief Veterinary Officer [HUTCHINS (E.)]. pp. 27–31.)

Diseases of Cattle. Rinderpest. This disease first appeared in the Mengo district of the Buganda Province in August 1913, and during the next two years it extended into other districts. Since March 1916, there have been no outbreaks of the disease amongst cattle or game in the Province, which is now at last free from this disease. "The epidemic was kept under control by the quarantine regulations, which were, on the whole, well observed and it was finally eradicated by the double inoculation of the greater proportion of all cattle in the infected areas, and also of those in the adjoining clean areas." During the three years in which the epizootic was prevalent in the district 23,000 cattle were immunised, being from one-half to two-thirds of the total estimated number of cattle in the infected areas. The number of uninoculated cattle which died during this period is estimated at 12,000. Numerous outbreaks were reported in some districts of the Eastern Province and in two districts of the Northern Province.

Rinderpest has never spread into the Western Province, which contains 350,000 cattle. The disease is widely prevalent in the territory to the south of the Uganda Protectorate.

"Rinderpest, which for the past seven years has taxed all the energies of the Veterinary Staff, has at last been brought under control to the extent that the only areas where it exists to-day are in the remote districts bordering the Sudan and British East Africa, and thus all danger of the epidemic extending through Uganda to Southern Africa has for the time being been removed.

"*Trypanosomiasis.* Losses from trypanosomiasis were not so serious amongst native herds in the Buganda and Western Provinces as in previous years. Only one outbreak was reported in the Mengo District, in Northern Singo.

"A large proportion of the Military Transport cattle working on the Bukakata-Mbarara road became infected and some transport teams owned by Indian traders also suffered heavily. There are no tsetse on this road but it is possible that some of the oxen became infected near Bukatata where *Glossina palpalis* is found on the lake shore.

"A number of the Government Transport oxen died from this disease on the Fort Portal-Mubendi road. There are no tsetse on this road. The source of infection was probably some transport cattle sent from Kampala to Matiri, the Transport Depot at Mile 161. The trypanosome (*T. pecorum*) would appear to have been transmitted at Matiri by *Tabanidae* and *Haematopota* which were exceptionally numerous there during the rainy season.

"In Kampala nine of the Municipal oxen became infected with *T. pecorum*. These were isolated and treated by intravenous injections of antimony potassium tartrate. Three (Nos. 2, 3 and 6) have recovered, their blood is not now infective for dogs and their general condition is good. Three others though still infected are improving in condition.

"Four (Nos. 8, 9, 10 and 11) out of five which became infected with *T. pecorum* in February, 1916, and received the same treatment recovered, and have been working regularly since May, 1916. The results from this line of treatment are the most promising of any yet obtained here and further experiments are being carried out this year.

"In 1914-1915, 28 of the Municipal oxen died from trypanosomiasis. In 1915-1916 eight died and in 1916-1917, two died. A microscopic examination of the Municipal oxen is now made weekly.

"Losses amongst cattle from trypanosomiasis, which became infected in areas in which no tsetse exist, have in past years been very heavy in Buganda. This is the most serious veterinary problem with which we have to deal. It is the greatest obstacle to the development of cattle transport in the Buganda and Western Provinces.

"The primary source of infection is the tsetse in the fly areas. Cattle, having become infected there, and subsequently being brought into contact with healthy herds in fly-free areas, have caused extremely heavy losses both amongst native herds and transport oxen.

"Many such outbreaks amongst cattle have occurred in areas in which tsetse have never been found, and in which the other domesticated animals do not become infected.

"In these cases the infection appears to be transmitted with most certainty by Tabanidae where these are present in any numbers. In some outbreaks stomoxys, and possibly haematopota, appear to have been the transmitting agents.

"Hitherto it has not been possible effectively to control the movement of cattle out of or through areas in which tsetse exist, but as these areas become better known and more accurately defined it should be possible, by the control of stock routes, to avoid the passage of cattle through fly areas and thus to bring about a very material reduction in the danger of infection from this source.

"*East Coast Fever.* This disease is endemic over the whole of the Buganda Province. In the Eastern Province it is not endemic in the Bugishu counties on the foot-hills of Mount Elgon nor in the north-eastern part of the Teso District. More work requires to be done in mapping out the non-endemic areas in the Eastern Province and in testing the immunity of cattle from outlying and more recently administered parts of the Province.

"Money has been sanctioned for the construction of a cattle dip in Kampala during this year.

"The grazing in and around Kampala is very heavily tick-infested, and it is hoped that when the regular dipping of cattle has been established, together with the eradication of ticks, a reduction in the number of biting flies which molest the cattle may also be effected by this means.

"In the Mubendi District a number of water buck died in November and December. When the first reports of game dying were received it was thought possible that rinderpest might have spread eastward from the Congo. Investigations made in January showed that deaths were due to an extraordinary heavy infestation by brown ticks. Filaria were found on examination of blood slides obtained from water buck.

"*Foot-and-Mouth Disease.* Foot-and-mouth disease has been more than usually prevalent during the past year, particularly in Ankole and Toro.

"At Mbarara there was an outbreak of a severely malignant form amongst the Military Transport and Supply cattle and a high percentage of the infected died. There were outbreaks of a very mild type in Kampala during February and March. No cases have as yet been seen in any animals except cattle.

"*Diseases of Goats and Sheep.* Contagious pleuro-pneumonia of goats was responsible for the deaths of a very large number of goats obtained from Ankole and Toro for the supplies of the Military forces on the Southern Frontier.

"In Karamoja, where the natives possess large flocks of sheep and goats, very heavy losses were reported during the exceptionally wet season in that district.

"Goat scab has been prevalent in the Teso and Bukedi districts and has caused very considerable mortality.

"*Diseases of Equines. Ulcerative Lymphangitis.* Eight cases amongst mules were reported. Lymphangitis was very prevalent amongst the Military mules on the Southern Frontier but most of these were kept going under treatment.

"*Trypanosomiasis.* Six deaths occurred in mules in the Southern Frontier from this disease.

"*Diseases of Dogs.* 37 cases of Piroplasmosis were treated in Kampala. Almost all of these recovered. One dog brought from Masindi to Kampala was found to be infected with *T. brucei* and died on arrival here."

UNION OF SOUTH AFRICA. **Department of Agriculture. Report with Appendices for the Year ended 31st March 1916.**—160 pp. f'cap. 1917. Cape Town: Cape Times, Ltd., Government Printers. [Price 3*s.* 6*d.*] (Appendix III. Veterinary Research. Annual Report of the Director [THEILER (A.)]. 1915–1916. pp. 45–49.)

This report first deals with a very considerable amount of routine work performed at the Onderstepoort, Grahamstown, and Pietermaritzburg Laboratories, consisting in the examination of smears and morbid specimens and the manufacture of vaccines against blue tongue, redwater and gall-sickness, anthrax, and blackquarter, the inoculation of mules against horse sickness, and agglutination tests for contagious abortion and glanders.

Besides this large amount of routine work a considerable amount of investigation into the nature of important animal diseases was performed. Full accounts of the experiments in connection with some of these diseases are promised in the Director's forthcoming Annual Report. A brief survey of the work done and the results obtained is given and on account of its importance it is reprinted as follows :—

"Generally speaking the year has been conspicuous by an enormous increase in the routine work, the natural result of which was a corresponding diminution of research. The lack of opportunity for research work was further accentuated by the absence for some months of several members of the staff on Active Service, amongst whom were two of my seven Veterinary Research Officers.

"The two main subjects of investigations were Lamziekte in cattle, and Horse-sickness, and I have dealt with these matters more fully.

"(1) *Lamziekte in Cattle.*—The investigations into Lamziekte are still being carried on at Armoedsvlakte, Vryburg, under the supervision of Mr. Viljoen. The initial object was to verify and control the results of investigations published by Professor Hedinger, with particular reference to the opinion expressed by him that Sarcosporidia were the cause of Lamziekte. At the outset this task seemed almost impossible of solution owing to the lack of information concerning the life history of these parasites, and although many other investigators had attempted to settle this question their efforts had not met with success. Under these circumstances I decided to continue investigations on the lines adopted by Professor Hedinger, but in addition to extend them so as to include the examination of material obtained from cattle that died on Armoedsvlakte from any cause whatever. In this way the examination of sections cut from muscles of different animals enabled me to compare the number of Sarcosporidia and the extent of the pathological lesions they caused in the cattle that died of Lamziekte and in those that died from other causes. The net result is that Sarcosporidia are found in all cattle, particularly in cattle in poor condition, and this latter fact was so obvious that we came to the conclusion that Sarcosporidia may be the cause of an illness, or anyway a cause of poverty, but not a cause of Lamziekte. This conclusion is supported by the fact that pathological lesions found in cattle showing a large number of Sarcosporidia are in no way associated with the lesions found in cattle that die of Lamziekte. Finally in Lamziekte animals a minimum number of parasites are found with a maximum of pathological changes indicating that the latter cannot be caused by Sarcosporidia. Accordingly, although investigations into relationship of Sarcosporidia to disease will still be continued, the one conclusion arrived at so far is that these parasites have no connection with Lamziekte.

"Accordingly I have had to return to the grass toxin theory, which still offers a better explanation for the cause of Lamziekte than any other, and using this theory as the basis for further research a new programme was planned and is now in course of operation. It is of interest to note that the disease has been located in a 12 acre paddock at Armoedsvlakte, and a thorough botanical survey has been undertaken by Mr. Pole Evans, with whose assistance feeding tests with plants (both infected and free from fungi) are now being undertaken.

"It had been my intention to lay out an artificial grazing ground at Armoedslakte to see whether Lamziekte would still be contracted by cattle grazing on such a pasturage, but the ground proved unsuitable for ploughing, and I therefore decided to undertake this work at Bestersput, near Bloemfontein. All the necessary arrangements have been made there and cattle transferred in readiness but no disease has appeared so far. A new experiment has been planned and partially carried out by removing soil from a Lamziekte to a non-Lamziekte area with the object of seeing whether the disease can be transferred. A number of possible preventive and curative measures have been attempted including injections of Trypanblue, Methylene Blue, Chloral Hydrate, Formalin, etc., but without success.

"(2) *Imapunga in Cattle.*—This disease of the Eastern Province is under investigation by Mr. Wm. Robertson of the Grahamstown Laboratory. Sixty head of cattle have been exposed on the farm Palmerstown and preparations made for inoculation and drenching experiments in the Laboratory. No disease has appeared so far amongst the exposed cattle.

"(3) *Contagious Abortion in Cattle.*—The object of these experiments was of a practical nature, based on enquiries made by various correspondents, and can be summarised as: (1) To see whether clean cows can become infected by a bull which has previously served cows that have aborted but have been isolated for at least 18 months and not allowed to be served. (2) To see whether it is possible by means of serum tests at intervals of two months to separate the infected cows from a herd in such a manner that the clean ones remain clean and no further positive reactions are obtained. (3) To see whether cows which have aborted and have calved normally afterwards are really immune and have not merely recovered though still capable of being re-infected. (4) To see whether in a cow which has calved normally, though a reactor, the bacillus of

contagious abortion is present in the milk or other excretions, and whether in the case of such a cow dying, the bacillus can be isolated from the uterine mucous membrane, etc. These experiments will have to be continued for another year, and although a considerable amount of information has been obtained, it is too early yet to make any announcement.

"(4) *Horse-sickness.*—The main objects of the past year's investigations have been two-fold, i.e., firstly, to improve the method of inoculation for rendering horses immune against the disease, and, secondly, to ascertain the protective value of dipping.

"The experience of previous years showed that the immunity conferred by inoculation was insufficient to protect horses against natural attacks of the disease and a considerable number had break-downs. Attention was, therefore, paid to this point whilst at the same time efforts were made to reduce the loss from inoculation.

"The desired objects have been satisfactorily achieved by the injection of two viruses, the second one being the virus that has been used successfully during the past few years for the inoculation of mules.

"Up to the end of the financial year this amended method has been used on 314 horses, of which 11 died as a direct or indirect result of inoculation, or 3·5 per cent.

"From these figures it will be seen that the mortality amongst horses is slightly higher than that experienced in mules, but even so it is better than our most sanguine hope of a 5 per cent. mortality. It now remains to be seen whether the low mortality can be maintained on a large number of horses. The immunity conferred by the improved method of inoculation has been tested by exposure experiments on 49 horses that were running at Onderstepoort during the worst time of last season. Two out of the 49 horses died of Horse-sickness, whilst three others contracted the disease and recovered, showing that a mortality of about 4 per cent. from relapses must be expected. The details of the investigations and experiments with the method of inoculation are now being compiled for publication in the Research Report.

"(5) *Dipping Experiments.*—Experiments to ascertain whether horses could be protected against Horse-sickness by periodical dipping were undertaken with the approach of the Horse-sickness season; 40 horses were sent to the Maritzburg Laboratory and 160 were kept at Onderstepoort, all of them being now dipped at different intervals in various dips and mixture.

"(6) *Pernicious Anaemia in Horses.*—Shortly before the outbreak of hostilities in Europe in 1914 a report was published by the Seyderhelms (father and son), of Strassburg, to the effect that Pernicious Anaemia was produced through the agency of Bots, and an announcement to this effect appeared in the South African Press. *A priori*, South African experience in the past seemed to negative this idea, but nevertheless it was deemed advisable to put the matter to the test at Onderstepoort. The result of our experiments was that Bots collected from the stomach of a horse that died of Pernicious Anaemia, when emulsified and injected into a susceptible horse, produced the disease in practically every instance. Further, Bots collected from the stomach of a horse not affected with Pernicious Anaemia did not produce the disease when injected into healthy horses. These were the results that we expected, showing that the Bots itself cannot produce Pernicious Anaemia, and although an emulsion of Bots collected from an infected horse produced the disease, it is a different matter whether Pernicious Anaemia could be transmitted through the medium of the adult flies (i.e., from larvae taken from horses with Pernicious Anaemia and by means of their eggs deposited on a susceptible horse).

"(7) *Wire Worms in Sheep.* The life history of the wire worm has been investigated further and much valuable data collected, which will serve as a basis to assist in the fight against the wire worm pest. Details of this work appear in the 3rd and 4th Scientific Report of the Director of Veterinary Research. It may, however, be stated that the mixture of Cooper's Dip and Blue Stone recommended by the Division, particularly when administered to infected sheep on two successive days, is such a powerful remedy that it expels practically all the worms from their

stomach. The remedy for wire worms is, therefore, a simple one, but their eradication cannot be expected from the medicines alone, and attention must be paid to the general management of sheep based on the life history of the worm itself.

"(8) *Trypanosomiasis.*—The investigations into Trypanosomiasis in Zululand, under the care of Mr. Mitchell, must be considered as a continuation of those undertaken last year by the Museum Expedition, the results of which corroborated the findings of the early investigations of Sir David Bruce, i.e., that game are infected with Trypanosomes (in our experiments Impala, Bushbuck and Zebra). The objects of the present investigations were not so much the repetition of the Museum Expedition work, but more to find out the extent of infection of Trypanosomes in Zululand, with particular reference to the spread of the disease and to the best means of prevention and eradication.

"An interim report has been submitted by Mr. Mitchell in which the following conclusions were drawn :—

"1. Wandering game are responsible for primary outbreaks of the disease.

"2. Tsetse flies will not travel from the original fly belt unless cover is continuous or in company with game.

"3. In the absence of Tsetse it is unlikely that outbreaks of Nagana could originate from recovered or partly recovered cattle or from game localised to the cattle grazing area.

"Certain recommendations have been made by Mr. Mitchell, with a view to localising game as far as possible and for their efficient protection in the Reserves, i.e. :—

"1. The issue of permits to Europeans and natives living in Nagana areas authorising them to destroy 'wandering game,' in preference to indiscriminate shooting and 'drives.'

"2. Such permits should be valid during the summer months as well as during the 'open' season.

"3. The destruction of game in infected areas should be encouraged by the issue of licences at reduced fees to non-residents.

"4. In the low veld areas where few if any cattle are to be found and in areas surrounding game reserves, the shooting of game under licence should be allowed.

"5. The effect of the above recommendations would necessitate increased supervision in game reserves, which could be effectively obtained by the appointment of an European ranger for each reserve and the surrounding district.

"6. The existing 'open' area on both sides of roads should be maintained for some time.

"7. The bush adjoining roads passing through tsetse fly areas should be repeatedly burned, and road repairs should be carried out at regular intervals.

"8. Finally, the assistance of owners is necessary to control Nagana, as insufficient herding, transport riding in summer in areas where the disease is endemic and lack of isolation measures are matters for owners to deal with and not the State.

"(9). *Gouw Ziekte in Sheep.*—An opportunity offered itself in the neighbourhood of Pretoria for further research in connection with this disease, and feeding experiments were undertaken to control the negative results obtained in the Lake Chrissie district in 1909. Investigations are now proceeding with the object of ascertaining the particular plant responsible but definite results are not yet to hand.

"(10). *Geel Dikkop in Sheep.*—This disease was brought to my notice for the first time this year, reports of outbreaks being sent in from the Hope Town and Colesburg districts. Mr. Walker was instructed to make local investigations and experiments were at once undertaken to ascertain whether the disease was infectious.

"Inoculation experiments were carried out but so far have proved negative, thus corroborating the results of earlier investigators. Muzzling experiments have also been undertaken to see if the disease is contracted through the mouth. Feeding experiments were also taken with Dubbeltjes, a plant considered by many farmers to be the cause, but without result.

"(11). *Ornithodoros Megnini. The Spinose Ear Tick.*—In 1912 a tick new to South Africa was discovered by this Division, and this year numerous reports have been made from various parts of the Union as to its prevalence. Mr. Bedford, the Entomologist of this Division, made personal enquiries in the Richmond area, and it appears that the tick is responsible for a considerable amount of trouble in sheep, goats, and calves—a short memorandum has been published giving our recommendations for the treatment of affected animals.

"(12). *Stiff-sickness in cattle and so-called 'Rickets' in Donkeys and Sheep.*—Enquiries into these diseases and the collection of material have been undertaken whenever opportunity occurred, and a considerable amount of material has been obtained, which will be worked up when time and staff permit.

"(13). *Jagziekte in Horses.*—Investigations into this disease are being carried out in Pietermaritzburg, the primary object being to reproduce the disease artificially.

"(14). *Dunsickness in Horses.*—Investigations into this disease are being continued at Onderstepoort and Pietermaritzburg. In Pietermaritzburg attempts are being made to produce the disease with worms which are commonly found in the Caecum and Colon of horses affected with Dunsickness. In Onderstepoort feeding experiments are being made with a plant, known as Ragwort, which is believed to have some connection with the disease. The plant has killed two horses, but the symptoms of Ragwort poisoning differ from those found in Dunsickness and further experiments will be necessary.

"*General Remarks.* It must be pointed out that notwithstanding the number of subjects coming under the heading of 'Research' which have been enquired into, only in three cases has it been possible to carry out investigations on systematic lines, and they are Horse-sickness, Lamziekte, and Wire Worms in sheep. The other diseases have been dealt with more for our own information at present with the object of collecting as much evidence as possible in a rough and ready manner. The minute and detailed examination that these other diseases deserve could not and will not be carried out unless more time is saved on routine duties or unless the staff is increased in proportion."

UNITED PROVINCES. **Annual Report on the Civil Veterinary Department for the Year ending 31st March 1917.** [HICKEY (S. G. M.), Acting Superintendent.]—22 pp. f'cap. With 14 tables. 1917. Allahabad: Superintendent Government Press. United Provinces.

During the year under consideration the reported mortality from various contagious diseases amounted to 15,473 cases. Rinderpest was responsible for 7,563 of the deaths recorded.

Equine contagious diseases coming under the control of the Civil Veterinary Department occur ed in four selected horse-breeding districts. Glanders broke out in six districts, and 41 animals either died from it or had to be destroyed. A severe form of surra occurred in one district where 118 animals either died or were destroyed. Many cases of tetanus were reported, of which 31 proved fatal. No cases of dourine or epizootic lymphangitis were detected. There were 599 cases of strangles, eight of which proved fatal. Equine piroplasmosis, horse pox, influenza, anthrax, and parasitic skin diseases occurred to some extent, but no statistics were available.

Bovine diseases. Rinderpest occurred in a more severe form than in the year 1915–16, most districts having been more or less affected. The total mortality during the year was reported as 7,563, as against 3,767 last year. Inoculations were carried out against it in 33 districts. Haemorrhagic septicaemia caused 1,777 deaths, as against 1,593 in the preceding year. The disease assumed a virulent form only in

five districts. Foot-and-mouth disease occurred in all but seven districts, the mortality being estimated at 1,373. The deaths were usually confined to young calves or old decrepit animals. Outbreaks of blackquarter were reported from 16 districts and caused a mortality of 700, as against 252 in the preceding year. Anthrax caused 1,109 deaths. 173 deaths were reported to have occurred from various other contagious diseases, including pleuro-pneumonia, tuberculosis, piroplasmosis, etc.

Pleuro-pneumonia occurred amongst sheep and goats to a very great extent in the district of Almora and destroyed 2,310 animals, while rabies, canine distemper, fowl cholera, and various diseases due to gross parasites accounted for deaths among the small domesticated animals.

The following table indicates the extent to which preventive inoculation was undertaken.

Name of disease against which inoculation was carried out	Method of inoculation followed	Number of outbreaks in which inoculation was undertaken	Number of animals which died uninoculated in course of outbreak		Number of animals inoculated		Number of animals which died after inoculation
			Bovines	Others	Bovines	Others	
Rinderpest ..	Serum alone	392	5,191	67	44,099	802	30
Haemorrhagic septicaemia	Serum alone	139	610	8	10,646	283	—
Haemorrhagic septicaemia	Vaccine	3	19	—	247	—	—
Blackquarter	Pillules	9	1	—	542	—	17

Details are also given with regard to cattle and horse breeding operations undertaken by the Department, the instruction of natives at Veterinary Colleges, and the organisation of the subordinate veterinary establishment.

Book Review.

Smythe (R. Harrison), M.R.C.V.S., Civil Veterinary Surgeon, attached A.V.C.—**Wounds of Animals and their Treatment.**—xi + 194 pp. With 30 figs. 1918. London: Baillière, Tindall & Cox.

This small work contains much useful information based on up to date knowledge of the treatment of wounds in animals. The disinfection, dressing, process of healing, infection, and the various complications and sequelae of wounds are carefully described. The pages devoted to wounds of the head and neck, limbs and feet, "poll-evil," "fistulous withers," "quittor," and war wounds are very well written. Altogether, it is a handy volume, which can be commended for its many valuable details of wound treatment.

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RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 5, No. 4, pp. 298–304].

PROTOZOAN PARASITES.

ARAGÃO (H. de B.). Espirochetose (Treponemose) das Gallinhas. [Fowl Spirochaetosis.]—*Rev. Vet. e Zootechnia*, 1917. Vol. 7. No. 1. pp. 3-10.

"Spirochaetosis in fowls, which is carried by the tick, *Argas persicus*, may be successfully treated by serum injections or organic arsenicals, such as atoxyl (0·03 grammes per kilo weight of the animal treated) or salvarsan (0·035 grammes). Prophylactic measures should include hygienic methods in the construction and upkeep of fowl-houses."—*Rev. App. Entom.* 1917. Dec. Vol. 5. Ser. B. Pt. 12. p. 190.

CHATTON (Edouard). Réalisation expérimentale chez le cobaye de l'amibiase intestinale à *Entamoeba dysenteria*. — *Bull. Soc. Path. Exot.* 1917. Nov. Vol. 10. No. 9. pp. 794-799. With 3 text-figs.

——. L'éclosion des kystes et les premiers stades de l'évolution de l'amibe dysentérique humaine chez le chat.—*Bull. Soc. Path. Exot.* 1917. Nov. Vol. 10. No. 9. pp. 834-841. With 9 text-figs.

COMMES (Ch.). Leucocytozoon et microfilaire d'un rapace diurne (*Astur badius*, var. *sphenurus*).—*Bull. Soc. Path. Exot.* 1918. Jan. Vol. 11. No. 1. pp. 31-34.

ESCOMEL (E.). Le *Phyllodactylus gerrhopygus* au Pérou. Son infection par une hémogrégarine.—*Bull. Soc. Path. Exot.* 1917. Dec. Vol. 10. No. 10. pp. 873-879. With 1 text-fig.

GALLI-VALERIO (B.). Observations sur *Eimeria zürni*, Rivolta.—*Schweizer Arch. f. Tierheilk.* 1918. Jan. Vol. 60. No. 1. pp. 7–17. With 1 text-fig.

HARTMANN (Max) & SCHILLING (Claus). Die pathogenen Protozoen und die durch sie verursachten Krankheiten, zugleich eine Einführung in die allgemeine Protozoenkunde. [The Pathogenic Protozoa and Diseases caused by them, with an Introduction into the Study of General Protozoology.]—462 pp. With 337 text-figs. 1917. Berlin: J. Springer. [Price. Mark 22. (bound Mark 24).]

LEGER (André) & LE GALLEN (R.). Etude expérimentale du pouvoir pathogène de *Spirochaeta crocidurae*.—*Bull. Soc. Path. Exot.* 1917. Oct. Vol. 10. No. 8. pp. 694–696.

LEGER (M.) & MOUZELS (P.). Hématozoaire endoglobulaire non pigmenté d'une Anatidée.—*Bull. Soc. Path. Exot.* 1917. Oct. Vol. 10. No. 8. pp. 699–700.

M'FADYEAN (J.). Coccidiosis in the Horse.—*Vet. Record.* 1918. Jan. 5. Vol. 30. No. 1539. p. 278.

In this letter the writer states that he was enabled to examine sections from the case of alleged coccidiosis referred to in the preceding number of this *Bulletin* (p. 298). He "was unable to detect any coccidia, or indeed anything remotely resembling coccidia."

MERCIER (L.) & MATHIS (C.) Kystes gamogoniques et schizogoniques chez *Entamoeba ranarum*.—*Bull. Soc. Path. Exot.* 1918. Jan. Vol. 11. No. 1. pp. 47–54. With 2 plates.

PONSELLE (A.). Déterminisme de la culture du trypanosome de la grenouille, *Trypanosoma rotatorium* Mayer, 1843. [Cultivation of the Frog Trypanosome.]—*C. R. Soc. Biol.* 1917. Nov. 10. Vol. 80. No. 17. pp. 824–826.

RHODESIA AGRICULTURAL JOURNAL. 1917. Oct. Vol. 14. No. 5. pp. 614–616. With 3 tables. African Coast Fever.

RODHAIN (J.) & VAN DEN BRANDEN (F.). Essais de transmission des parasites de la malaria à la roussette, *Cynonycteris straminea* (Note préliminiare).—*Bull. Soc. Path. Exot.* 1917. Oct. Vol. 10. No. 8. pp. 704–706.

SERGENT (Etienne). Sur un *Leucocytozoon* de la perdrix rouge d'Algérie (*Perdix rubra* Brisson.)—*Bull. Soc. Path. Exot.* 1917. Oct. Vol. 10. No. 8. pp. 701–702. With 1 text-fig.

STEVENSON (A. C.). The Presence of Trypanosomes in Brain Substance.—*Jl. Trop. Med. & Hyg.* 1918. Jan. 15. Vol. 21. No. 2. p. 17. With 1 plate comprising 6 figs.

TRIBONDEAU (L.). Recherche des hématozoaires sur préparations de sang à deux épaisseurs (nappe mince et tache épaisse). [Discovery of Haematozoa in Thin Films and Thick Layers of Blood.]—*C.R. Soc. Biol.* 1917. Dec. 22. Vol. 80. No. 20. pp. 942–945.

METAZOAN PARASITES.

Arthropods (Acari, Flies, Ticks).

BAKER (A. W.). Preliminary Notes on the Use of Repellents for Horn Flies and Stable Flies on Cattle.—*47th Ann. Rept. Entom. Soc. Ontario for 1916.* Toronto. 1917. pp. 52–56.

CHRISTY (Cuthbert.). Tsetse Flies and Fly-Belts.—*Ann. Trop. Med. & Hyg.* 1918. Jan. 31. Vol. 11. No. 3. pp. 279–282.

CROSS (H. E.). Experiments with Emulsions for protecting Camels against the Attacks of Blood-Sucking Flies.—*Agric. Res. Inst. Pusa.* 1917. Bull. No. 76. 11 pp. 1917. Calcutta: Superintendent Government Printing, India. [Price As. 2 or 3*d.*]

The preparations tried were kerosene oil emulsion, taramira (*Eruca sativa*) oil emulsion, an emulsion containing eucalyptus oil and turpentine, asafoetida solution, chirpine oil emulsion, creosol emulsion, Jensen's emulsion (which contains kerosene oil and powdered naphthaline), citronella oil. aniseed oil, cod liver oil, and castor oil. Conclusions: "Of the preparations used the only one that prevented Tabanidae from attacking for any length of time was castor oil, but it cannot be recommended on account of cost. None of the other preparations tried are of any practical value. As soon as the emulsions dry they have no repellent action against the flies."

HIRST (S.). Remarks on Certain Species of the Genus *Demodex*, Owen (the *Demodex* of Man, the Horse, Dog, Rat, and Mouse.)—*Ann. & Mag. Nat. Hist.* 1917. Sept. Vol. 20. No. 117. pp. 232–235.

MACGREGOR (Malcolm Evan). A Summary of our Knowledge of Insect Vectors of Disease.—*Bull. Entom. Res.* 1917. Dec. Vol. 8. Pt. 2. pp. 155–163. With 7 tables.

MARCHAND (Werner). An Improved Method of rearing Tabanid Larvae.—*Jl. Econom. Entom.* 1917. Oct. Vol. 10. No. 5. pp. 469–472.

MELANDER (A. L.) & SPULER (A.). The Dipterous Families SEPSIDAE and PIOPHILIDAE.—*Washington Agric. Expt. Sta.* 1917. Apr. Bull. No. 143. 97 pp. With 1 plate.

Railliet & Henry. Un nouveau foyer de gale sarcoptique (*Sarcoptes scabiei*) du lapin.—*Bull. Soc. Cent. Méd. Vét.* 1917. Nov. 8. *Rec. Méd. Vét.* 1917. Nov. 30. Vol. 93. No. 22. pp. 436–441.

Recueil de Médecine Vétérinaire. 1917. Dec. 15. Vol. 93. No. 23. pp. 653–655.—Conclusions d'un rapport de M. le vétérinaire principal Jacoulet, sur les essais pratiques de traitement de la gale des chevaux par les gaz sulfureux, selon le procédé du vétérinaire aide-major Lépinay. [Treatment of Mange in Horses by Means of Sulphur Gases.]

Snyder (T. E.). Notes on Horse-Flies as a Pest in Southern Florida.—*Proc. Entom. Soc.* Washington. 1916. Dec. Vol. 18. No. 4. pp. 208–211.

du Toit (P. J.). Ueber Zecken und deren Bekämpfung. [Ticks and their Eradication.]—*Ztschr. f. Infektionskr. d. Hausliere.* 1917. Oct. Vol. 19. No. 1. pp. 1–16 (to be continued).

Townsend (C. H. T.). The Head and Throat Bots of American Game Animals.—*Jl. New York Entom. Soc.* 1917. June. Vol. 25. No. 2. pp. 98–105.

Turner (Rowland E.). On a Braconid Parasite of *Glossina*.—*Bull. Entom. Res.* 1917. Dec. Vol. 8. Pt. 2. p. 177.

Urbain (G.). Un cas de gale démodécique du cheval avec contagion à l'homme. [A Case of Equine Demodectic Mange with Transmission to Man.]—*Bull. Soc. Cent. Méd. Vét.* 1917. Oct. 11. *Rec. Méd. Vét.* 1917. Oct. 30. Vol. 93. No. 20. pp. 370–372.

Waterston (James). Chalcidoidea bred from *Glossina* in the Northern Territories, Gold Coast.—*Bull. Entom. Res.* 1917. Dec. Vol. 8. Pt. 2. pp. 178–179. With 1 text-fig.

Helminths.

Ackert (James E.). A Means of Transmitting the Fowl Nematode, *Heterakis papillosa* Bloch.—*Science.* 1917. Oct. 19. N.S. Vol. 46. No. 1190. p. 394.

Ackert (J. E.) & Grant (A. A.). Another Cestode from the Young Cat.—*Trans. Amer. Microscop. Soc.* 1917. Apr. Vol. 36. No. 2. pp. 93–96.

Fitch (C. P.). Parasites affecting Sheep.—*Cornell Vet.* 1917. Oct. Vol. 7. No. 4. pp. 233–254. With 4 plates.

Railliet (A.). L'oxyurose des Equidés. [Oxyuris Infestations of Equines.]—*Rec. Méd. Vét.* 1917. Oct. 15. Vol. 93. No. 19. pp. 517–541.

MYCOTIC DISEASES.

Belin. Traitement des lymphangites épizootique et ulcéreuse par l'autopyothérapie.—*Bull. Soc. Cent. Méd. Vét. Rec. Méd. Vét.*, 1917. Sept. 30. Vol. 93. No. 18. pp. 346–362.

——. Note complémentaire relative à la préparation du pyovaccin employé dans le traitement des lymphangites épizootique et ulcéreuse.—*Bull. Soc. Cent. Med. Vét.* 1917. Nov. 22. *Rec. Méd. Vét.* 1917. Nov. 30. Vol. 93. No. 22. pp. 462–465.

FAYET, LEYSSES, & PRUDHOMME. Une localisation rare de la lymphangite épizootique. Présen ation de pièces. [A Rare Seat of Epizootic Lymphangitis (in the Postpharyngeal Lymphatic Glands).]—*Bull. Soc. Cent. Méd. Vét.* 1917. Nov. 8. *Rec. Méd. Vét.* 1917. Nov. 30. Vol. 93. No. 22. pp. 444–446.

FRANS. Lymphangite épizootique; quelques traitements.—*Bull. Soc. Cent. Méd. Vét.* 1917. Dec. 20. *Rec. Méd. Vét.* 1917. Dec. 30. Vol. 93. No. 24. pp. 527–533.

RULLMANN (W.). Weitere Angaben über die Unterscheidung der drei Genera Cladothrix, Streptothrix und Actinomyces. [Further Data for the Differentiation of the Three Genera C., S., and A.]—*Cent. f. Bakt.* I. Abt. Orig. 1917. June 28. Vol. 79. No. 6. pp. 383-390. With 1 plate comprising 8 figs.

VELU. Quelques cas typiques de traitement de la lymphangite épizootique par la Pyothérapie.—*Bull. Soc. Cent. Méd. Vet.* 1917. Dec. 6. *Rec. Méd. Vét.* 1917. Dec. 30. Vol. 93. No. 24. pp. 511–524.

DISEASES DUE TO FILTERABLE VIRUSES.

KUETHE. Rinderpest in der Türkei (wébei bakarý). [Rinderpest in Turkey.]—*Berlin. Tier. Woch.* 1917. Dec. 20. Vol. 33. No. 51. pp. 541–544. With 6 text-figs.

MESTRE. Rage paralytique chez un cheval. [Paralytic Rabies in a Horse.]—*Bull. Soc. Cent. Méd. Vét.* 1917. Nov. 22. *Rec. Méd. Vét.* 1917. Nov. 30. Vol. 93. No. 22. pp. 461–462.

SCHERN (Kurt). Beiträge zur Kenntnis der Methylengrünreaktion gelegentlicher Studien über Rinderpest und Piroplasmose. [Methylene Green Reaction (of the Urine) in Rinderpest and Piroplasmosis.]—*Berlin. Tier. Woch.* 1918. Jan. 17. Vol. 34. No. 3. pp. 21–22.

BACTERIAL DISEASES.

VON BOÈR (W.). Eine Darminfektion des Menschen, verursacht durch den Hühnercholerabacillus. [A Human Intestinal Infection caused by the Fowl Cholera Bacillus.]—*Cent. f. Bakt.* I. Abt. Orig. 1917. June 28. Vol. 79. No. 6. pp. 390–397. With 3 text-figs. & 1 coloured plate comprising 2 figs.

ELDERS. Un caso di pasteurellosi nell'uomo. [A Case of Pasteurellosis in Man.]—*Nederl. Tijdschr. v. Geneesk.* 1916. p. 1391. Extracted in *Clinica Vet.* 1917. Dec. 15. Vol. 40. No. 23. pp. 699–700.

FAYET. Quelques faits d'observation sur la "Lymphangite ulcéreuse." *Bull. Soc. Cent. Méd. Vét.* 1917. Dec. 6. *Rec. Méd. Vét.* 1917. Dec. 30. Vol. 93. No. 24. pp. 508–511.

GREELEY (Horace) & JOHNSON (W. L.). An Epizootic of Poliomyelitis among Dogs.—*Med. Record.* 1917. Nov. 17. Abstracted in *Jl. Trop. Med. & Hyg.* 1918. Feb. 1. Vol. 21. No. 3. pp. 34–36.

[The authors describe a small outbreak of poliomyelitis among dogs in a suburb of New York with lesions affecting the central nervous system corresponding with those observed in human poliomyelitis. From the cords and brains of the animals "a usually Gram-negative, pleomorphic bacillus was isolated." A young dog inoculated with cultures of this organism "developed typical symptoms (paraplegia and fever) and lesions."]

M'Fadyean (John) & Edwards (J. T.). Contagious Abortion in Mares and Joint-Ill in Foals: Etiology and Serum Treatment.—*Jl. Comp. Path. & Ther.* 1917. Dec. Vol. 30. Pt. 4. pp. 321–366. With 2 text-figs. & 2 tables.

Piorkowski. Beitrag zur Frage der Identität der Geflügel- und Menschendiphtherie. [The Identity of Fowl and Human Diphtheria.]—*Berlin. Tier. Woch.* 1917. Nov. 29. Vol. 33. No. 48. p. 515.

MISCELLANEOUS.

Armfield (J. Malcolm). A Few Diseases Affecting Animals in Northern Rhodesia.—*Vet. Record.* 1918. Jan. 5. Vol. 30. No. 1539. pp. 272–277. With 1 plate comprising 3 figs.

Burnett (Samuel Howell). The Clinical Pathology of the Blood of Domesticated Animals. Second Edition revised and enlarged. 1917. New York: The Macmillan Company.

Chick (Harriette) & Hume (E. Margaret). The Distribution in Wheat, Rice, and Maize Grains of the Substance, the Deficiency of which in a Diet causes Polyneuritis in Birds and Beri-Beri in Man.—*Proc. Roy. Soc.* 1917. Dec. Ser. B. Vol. 90. No. B624. pp. 44–60.

—— The Effect of Exposure to Temperatures at or above 100° C. upon the Substance (Vitamine) whose Deficiency in a Diet causes Polyneuritis in Birds and Beri-Beri in Man.—*Proc. Roy. Soc.* 1917. Dec. Ser. B. Vol. 90. No. B624. pp. 60–68.

Desoubry. Stomatite contagieuse du cheval.—*Bull. Soc. Cent. Méd. Vét.* 1917. Nov. 8. *Rec. Méd. Vet.* 1917. Nov. 30. Vol. 93. No. 22. pp. 441–443.

Jolly (Paul). Sur la stomatite vésiculeuse contagieuse du cheval. *Bull. Soc. Cent. Méd. Vét.* 1917. Dec. 20. *Rec. Méd. Vét.* 1917. Dec. 30. Vol. 93. No. 24. pp. 534–539.

Nicoll (William). The Conditions of Life in Tropical Australia.—*Jl. Hygiene.* 1917. Dec. Vol. 16. No. 3. pp. 269–290.

Stockman (Stewart). Bracken Poisoning in Cattle in Great Britain.—*Jl. Comp. Path. & Ther.* 1917. Dec. Vol. 30. Pt. 4. pp. 311–316.

Van den Branden (F.). La roussette, *Cynonycteris straminea*, animal de Laboratoire.—*Bull. Soc. Path. Exot.* 1917. Oct. Vol. 10. No. 8. pp. 731–732.

Wright (Lewis H.). Some Notes on Poisoning by Sorghum (*Andropogon Sorghum*).—*Amer. Jl. Vet. Med.* 1917. Dec. Vol. 12. No. 12. pp. 857–858 & 884–885.